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# Electrical World

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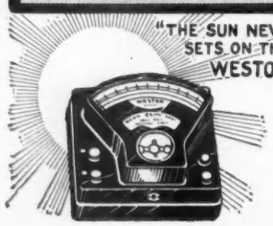


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# Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*

Published by McGraw-Hill Company, Inc.

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*Volume* 80 — New York, Saturday, September 30, 1922 — *Number* 14


# *The Fascination of the Unknown*

AT THE bottom of every man's heart lies the desire to discover or explore. As long as humanity endures it will thrill to the tales of adventure and hardship in unknown regions. Columbus sighting land, Balboa staring at the Pacific from his Darien peak, Stanley threading the African jungle, Peary at the North Pole, are universal heroes. To such men themselves must come a sense of victory pure and unalloyed which no successful warrior or statesman ever felt. What the warrior or the statesman achieves today tomorrow may destroy, but the discoverer's triumphs are concrete and immutable.

The thing is as true of scientific as of geographical exploration. The poet has linked with the ecstasies of the discoverer of the Pacific those of the astronomer at the moment "when a new planet swims into his ken." The same recompense has come to the successful experimenters in every branch of knowledge—the men who have left others to pursue the obvious while they with inexhaustible patience and courage follow the lure of the unknown. Surely only the fascination associated with the work of research holds such men to their tasks, for their material recompense is out of all relation to their educational training and their mental ability.

TO MEN engaged in materialistic occupations is sometimes permitted a fugitive glimpse of these hidden mysteries of science—a glimpse usually made possible by the work of a research engineer who has replaced speculative philosophy by experimental delving. To each of us, indeed, in some degree there comes at times the overwhelming satisfaction that is associated with a creation or a discovery; thus we comprehend why some men devote their lives to research without thought of material gain.

In no branch of science has research established a greater monument than in electricity. That mysterious force possesses inherent elements of interest to those with the capacity for analysis or vision because it is so all-pervading yet physically so intangible. Few are capable of grasping the work of Faraday, Maxwell or Kelvin except through its adaptation to engineering mechanisms, yet all render these men unstinted honor.

HAD we the proper perspective to recognize them, there are equally worthy living investigators who are seeking the unknown, and often finding it, in the secluded research laboratories of great manufacturing establishments and in the quiet halls of our institutions of learning. To these men too frequently we render no homage, but rather dismiss them and their work as theoretical or impracticable and even scoff at their results because they have no apparent application to utilitarian purposes. It would be much more fitting to concede to these explorers of the unknown their place as leaders in the profession who are doing the work that really makes for an advance in our art. Let us encourage and honor those who build for future generations.

# Frank D. Newbury

*Designer of alternating-current machinery and an authority on machine temperature limits.*

THOUGH practically all electric machinery in general use today is the result of the work of many minds and represents in a very true sense the best thought of the entire industry, there is a group of men who are the acknowledged leaders in electrical machine design and who are chiefly responsible for the rapid progress that is characteristic of American electrical manufacturing. Among these is Frank D. Newbury, manager of the power engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. Mr. Newbury has devoted his entire professional life to the design and construction of alternating-current machinery. He took the apprenticeship course of the Westinghouse Electric & Manufacturing Company in 1901, immediately after his graduation from Cornell University, and when he had completed this training he entered the alternating-current generator section of the Westinghouse company's engineering department. Here he steadily advanced until finally he was placed in charge of the power engineering department.

Among the important developments that have been carried out under Mr. Newbury's supervision are the development of the present Westinghouse standard lines of belted and engine-type generators, the designing of self-starting synchronous motors, self-starting synchronous converters and high-speed 60-cycle synchronous converters, and the construction of single units of great capacity.

He has carried out a number of careful researches with the object of improving the performance of alternating-current rotating machinery. The increase in the efficiency of large machines to the almost theoretical limits of 97 per cent for turbine-driven generators and more than 98 per cent for waterwheel generators is to a great extent due to Mr. Newbury's investigations. He has also paid special attention to the subject of the internal heating of these machines and has decreased to a marked extent the possibility of damage due to hot spots. His papers on temperature distribution within generators form a valuable addition to engineering literature and his researches along these lines have led to important discoveries.

Mr. Newbury has been a manager of the American Institute of Electrical Engineers since 1918 and has been active in the committee work of the Institute. He is a member of the standards committee and chairman of the rotating machinery sub-committee of the standards committee. He is also a member of the power station and electric machinery committees of the Institute.

The accurate, analytical mind of Mr. Newbury has always been at the service of the electrical industry, and a host of friends evidence the respect and affection with which he is regarded. He has always been interested in the education of engineers and is well known as a lecturer in several engineering schools. His services as a lecturer are also in demand by sections of the American Institute of Electrical Engineers. The influence of Mr. Newbury in shaping the developments in electrical machinery has been directed toward obtaining improved performance and has been based on scientific knowledge and investigation.

# Editorial Comment

Electrical World, September 30, 1922

Volume 80 Number 14

### The Congressional Session Just Ended

THE present session of Congress having ended, it is well to recall what has been accomplished. So far as the electrical industry is concerned, definite legislation has been for the most part lacking, and when one contemplates the laws that were piled one on the other, this is not a subject of lament; rather, we should be thankful. The less we have of laws the better off we shall be. The noxious Bacharach bill, opposed by commissions and damned by the legal profession, never got beyond the judiciary committee. For this relief electric light and power companies and all public utilities should return thanks. Manufacturing interests center chiefly in the new tariff, and manufacturers are welcome to whatever comfort they can derive from it.

Muscle Shoals as an issue has been clarified, thanks to the initiative, sanity and courage of Representative Charles C. Kearns of the Sixth Ohio District and Senator Norris of Nebraska. Without discourtesy or ungraciousness to the members of the Senate committee on agriculture who followed Representative Kearns with much more bitter denunciation of the attempt to grab Muscle Shoals, it is only fair to record the fact that it was he who first told the country in a big public manner the real truth about Muscle Shoals and the offer of Henry Ford. A lot of water has gone over a great many dams since the false cry "Cut the farmer's fertilizer bill in half" was coined by certain organizations and put in circulation among women's clubs, boy scouts, posts of the American Legion, organizations of ministers of colored churches in the South, real-estate speculators and just plain politicians seeking the farmer vote. For some time now the tumult and the shouting of the misinformed have died away, and the captains and the kings of propaganda seem to have departed from Washington, apparently unable to endure the blinding glare of the truth.

Aside from the recent legislation affecting the coal industry, no other outstanding measures of particular concern to public utilities were considered by Congress during the last session. This is a matter for congratulation all around.

### The Value that Springs from Words of Appreciation

"YOU have a loyal organization and one that is efficient, but it is starving for a word of appreciation," was the report that a delegate to the Detroit meeting of the National Safety Council told of giving to an executive whose organization he had been called upon to examine. As in many another case of the same kind, the assertion was a real shock to the executive, who had prided himself on his organization and behind the mask of indifference had hidden a real appreciation of his men. With all the talk of right public relations, there is yet a large body of men in official position who fail to realize that the biggest single asset they have is the group of employees under their direction. All the justice and squareness that an executive can exercise in dealing with these employees is likely to be unseen unless sympathy and a ready word of appreciation go with the day's work.

In this must be included courtesy in contact with the employees in the every-day routine and an attitude that will encourage men to come with their difficulties to the "boss" for a free discussion and will lead them to take an interest in the business itself because they know that their interest is keenly appreciated. Courtesy and appreciation on the part of the executive will be reflected in the dealings the organization has with the public, because these two factors are the ones that take the rough edge off unpleasant experiences in the day's work and create contented and happy men who are proud of their work. Only such men can meet and deal properly with the public.

### The Larger Problems of Electric Power Supply

ONE of the very noteworthy papers before the Association of Iron and Steel Electrical Engineers was that by Dr. Steinmetz on industrial power supply and its relation to public power supply. The subject is a big one, and Dr. Steinmetz handled it in a large and stimulating way. His fundamental conception of the situation is that power production has become a separate industry and that it is more economical, speaking broadly, to obtain power from this specialized source than to produce it for the individual use of an industrial plant. Few engineers will be disposed to differ from these conclusions, since unquestionably the supply of electric power is a highly specialized industry capable of being conducted on so vast a scale as to permit extraordinary economies in operation. Granted this condition in electrical power supply, the inference is strongly against substantial competition from any individual source. As Dr. Steinmetz very plainly points out, one of the fundamentals of the situation is that the power-producing industry can benefit from diversity factor to an extent that is rarely possible in any single branch of industry.

Electrical power is one of the very few important commodities that cannot be stored under any conditions practicable on a large scale. It has to be made as used, and therefore the load factor of the system, which is determined very largely by the diversity factor, is all-important to economy; yet conditions may arise in which the balance quivers or turns in the opposite direction, and the analysis of these is an important economic matter. In exceptional industries a very high load factor is possible—higher perhaps than can be attained by a specialized power-producing plant even

with the help of its diversity factor—for as a rule diversity factor is attained only at the expense of a far-flung distribution and consequently at a relatively high cost. The diversity which could conceivably be obtained within a single city block reacts much more favorably on the cost of generation than if it had to be obtained over a twenty-mile radius. It may happen then that an independent plant operating as part of some specific industry will win out in the matter of load factor, including diversity. If such should be the case, then the relative cost of operating locally and obtaining energy from a public supply becomes somewhat dubious. If the individual industrial plant be a large one, the cost of generating power may drop below the cost of buying it at the end of a transmission line.

No one can say exactly what is the variation of cost with size of plant. The facts differ in different localities and under different circumstances, but the curve expressing the variation of cost with size does grow asymptotic, and when a value is reached which is close enough to that asymptotic value to leave insufficient room for transmission cost, then the scale turns to the favor of the smaller plant on the spot. Similarly, where there is by-product power unusable for commercial purposes it may be turned to power production at very great advantage. Such cases are the exception rather than the rule, however, and Dr. Steinmetz examines with keen analysis the mutual relations which may exist between a power system and an industry with available by-product energy. In such cases co-operation may be established to great advantage, power being supplied to the industry when its by-product power is small and in part turned back to the power supply when the by-product is plentiful.

The case closely resembles one which is not infrequent in hydro-electric practice where a transmission system takes on an industrial steam plant not as customer but as ally, turning over to it power when available at high water and receiving from it in return needed aid when the water runs low. It often requires very fine figuring to see exactly what the equities in the matter of price are in these intricate cases. It has usually proved possible, however, to strike a balance which seems to be and is advantageous to both parties as against treading their separate paths. Such may undoubtedly be the case in dealing with by-product power. The principles, indeed, are quite the same as in case of a network served both by steam and by electric plants of various sizes operating under diverse conditions. It requires the wisdom of the serpent to plan the systematic operation of the several units in such a way as to secure maximum economy. In actual fact the schedule of operation with respect to load and water conditions may vary greatly from one system to another. In fact, we have published recently examples showing utterly diverse general schemes of operation, each, however, meeting its own economic requirements. In the long run the relations between the big industrial power consumer and the public system which serves him has to be based, as Dr. Steinmetz intimates, on man-to-man equity. It is not in the long run a safe expedient to charge what the traffic will bear, even when camouflaged, as Dr. Steinmetz hints, into "based on the value of the service to the user." The "square deal" has been the foundation of success in the production and distribution of electric power, and the greater the structure of interlocked industries and super-power systems the more necessary will be this foundation stone.

## Why Not Eliminate Unnecessary Equipment?

THE means provided to facilitate maintenance are often viewed in too exact a light by both the designer and the operator. The article in this issue describing a substation of the Richland Public Service company of Mansfield, Ohio, is an illustration of what can be done if preconceived ideas are not too tenaciously held. It is probable that the tendency of nearly every designer in the case of a substation as important as this one would be toward the installation of duplicate oil switches. As a matter of fact, the cost of the duplicate equipment under the operating conditions that prevail is not justified, and air-break switches installed as transfer and by-pass switches do the trick just as well and with less investment cost.

The installation is an excellent illustration of the way in which design should be carried out. The first and fundamental question in the installation of any equipment is its worth from the viewpoint of the service to be given. This cannot always be valued in terms of dollars, but it can be valued in terms of the danger of interruptions to service and the probability of their occurrence with resulting damage. In the particular design described the cost of the duplicate oil-switch equipment that might be theoretically desirable was too high for any benefit that could be derived. None the less it was seen that future conditions might force its use, and therefore a place for its installation was provided at virtually no increased expense. The equipment throughout shows the same careful estimate of present and future needs. This is the sort of consideration that every plant unit should have.

## Salesmanship and Engineering

A GOOD many recent discussions on the merchandising of almost everything from spark plugs to illumination bring out in bold relief the relations of salesman to engineer. Every branch of the electrical art has gone through a succession of curiously interrelated phases—the invention of a new device; its development, usually at the skilled hands of engineers associated with manufacturers; its standardization, when these engineers are told to keep hands off and let well enough alone; its exploitation; the call for improvements, which rings louder and louder from customer and independent engineer until something has to be done—and then the same cycle over again. Some of the most accomplished engineers have also the instincts of the skillful salesman, but the combination is a scarce one. The engineer certainly gets in the salesman's way a great many times and is hence unpopular. Yet even in these days the consumer has some rights which must be seriously considered, and the engineer is about the only person who is disposed to enforce these against all comers.

In fact, however, the salesman and the engineer ought to be much better friends than they are, and in branches of the business where the engineering skill back of the salesman is high there is relatively little collision and often fairly efficient co-operation. One of the most striking of recent tendencies is toward the provision of engineering facilities without ostensible charge by manufacturers. Sometimes these facilities are uncommonly good, at times even better than could

be obtained elsewhere, but as the turn of the wheel goes on toward standardization and pure salesmanship the manufacturer's engineer often finds himself cornered, and even morally incarcerated, lest he interfere with the beautiful symmetry of the sales department.

The relation of the consumer to those who make, design, sell and advise may perhaps be best expressed as follows: If you were going to buy an expensive used motor car, would you take the word of the garage man as to its actual condition or, with some thousands of dollars at stake, would you take along an expert mechanic having no association with this particular branch of the motor-car business and get his judgment as to whether the machine was in thoroughly good condition or not?

Right here is the function of the engineer. He may not know the chassis as well as the man who built it, or the virtues of the car in general as well as a man who is trying to sell it, but he can tell the customer whether, mechanically speaking, he is getting his money's worth.

## More Knowledge Needed of Security Selling

EVERY thinking central-station man today realizes that the selling of junior securities to customers is more than a method of raising money, important as that is. It is the key to a door that opens wide the way to greater popularity and prosperity. It is a new source of capital, a new defense against the politician who attacks the corporation that appears to have few friends. But with all this accepted in principle, the question comes: How can the stock be sold year after year to help provide five dollars to finance each additional dollar of new business taken on?

The idea of selling stock to customers of the company through the co-operative work of employees is naturally appealing. Each organization to which it is properly presented responds enthusiastically, and the campaigns which they make are almost universally successful when the methods employed are in any way well organized. There have been some failures, but that is understandable, inevitable.

But the industry needs to know—what *are* the right methods under varying conditions? Why have the profitable and creditable campaigns worked out so well? And what are the definite mistakes that have brought disappointment to other companies? There is too meager a recorded knowledge of both the things to do and the things not to do in selling utility stock to the community served. Too little is really certain about this new and complex problem, but it should be possible to develop much information in useful form.

This is an appeal to central-station companies that have sold stock to their customers and those that are engaged in such campaigns at the present time to give more thought to the careful recording and reporting of their experience. For instance, what is best—if there is any best and if not what is good—in sales plans and campaign methods?—in methods and results of publicity?—in hiring, schooling, compensating and handling salesmen?—in methods of dealing with banks?—in maintenance of market and resale?—in methods of accounting and collecting? What should be the cost of selling securities under varying conditions? What are the possibilities for saturation in selling to customers?

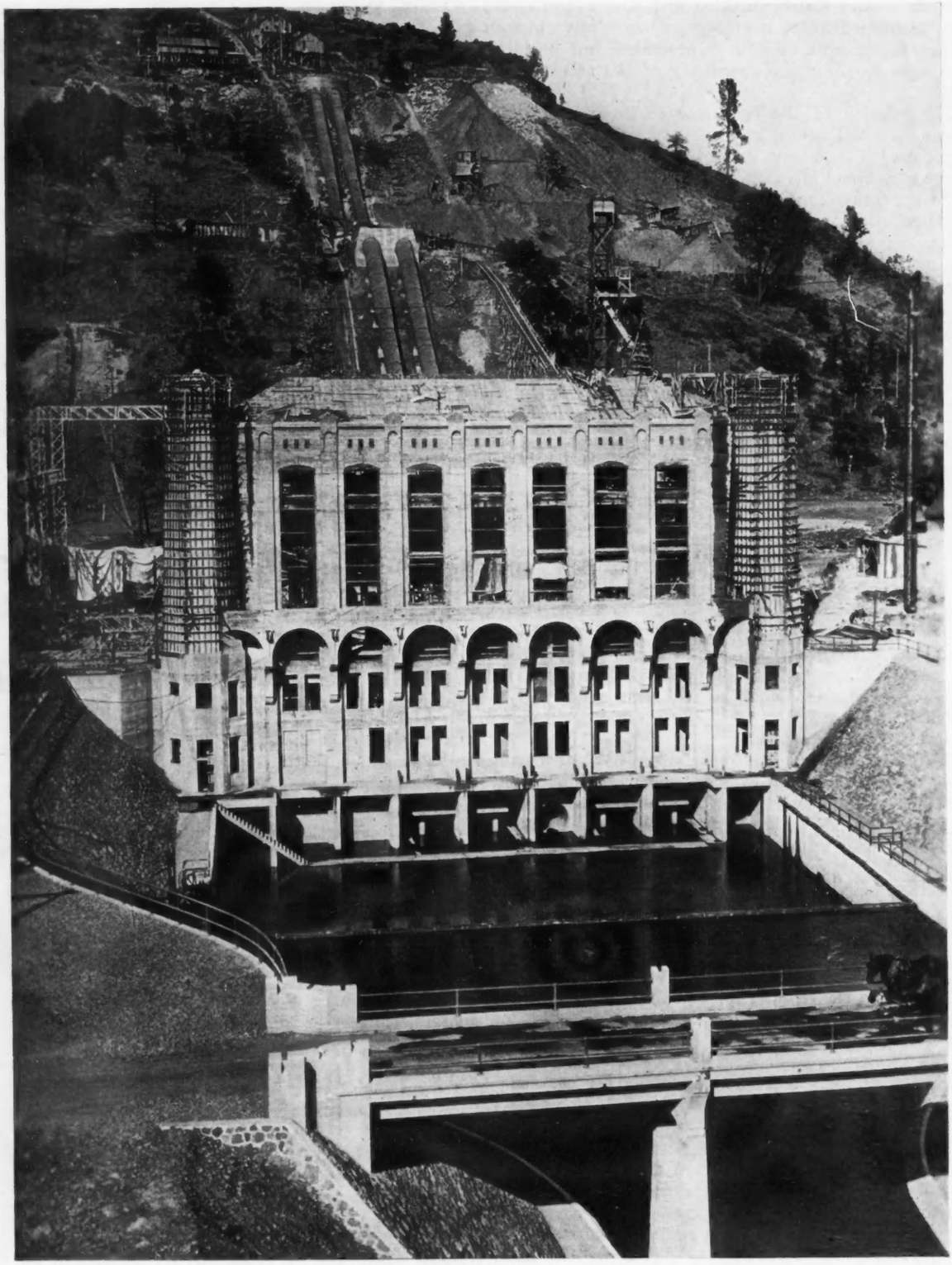
## Comprehensive Electrical Projects in Russia

A DISCUSSION by Dr. Steinmetz of the official propositions for extensive electrical development in Russia is naturally a matter of interest. That Russia, in addition to other huge sources of potential wealth, has great stores of fuel and immense hydro-electric resources may be taken for granted. The summation of these which Dr. Steinmetz considers in some detail was made at the instance of the putative Russian government within the last two years, a fact which detracts from its weight as a technical document. Yet it doubtless correctly describes much that exists in the way of resources and possible projects for present or future execution. The most interesting feature to the world's engineers will be the stress which is laid on the great resources in coal and iron of southern Russia, resources so great as to permit, when suitably developed, even of the exportation of anthracite to add to the world's supply. Virtually all the useful varieties of coal are represented in this region, and the facilities for steel making from the adjacent iron mines are exceptionally good. There are of record in southern Russia a very considerable group of steel mills, demanding altogether about 30,000 kw., and perhaps double this capacity is required for coal mines. What the actual output of these mines and mills is at the present time is an entirely different question, as is the prospect of stable and efficient operation under the existing Russian organization.

In the Caucasian district there seems to be a better chance for the resumption of normal industrial activities than in most other Russian territory. Here water-power plants can be made available, and in the oil fields there are good possibilities for the exploitation of surplus fuel oil in certain regions. At Baku it may be long before the production reaches the point where oil can be spared for fuel. All up and down the Volga district, where there is great lumber supply, both timber scrap and hydraulic resources can be to a certain extent utilized. Even the somewhat rosy report of the commission leaves considerable doubt, however, concerning the likelihood of rapid rehabilitation. There are stated to be very great resources of peat in Russia, particularly in the delta of the Volga. The project of a regional power plant with peat fuel is an interesting one. Attempts to utilize peat for fuel have usually led to economic disaster, but what might be possible under the labor conditions in Russia, at least temporarily, remains to be seen. Finally in north Russia and the Urals there is ample opportunity for hydro-electric plants adequate for power supply.

The total cost of the improvements sketched out runs to nearly $600,000,000, and the statement that the possibility of carrying out this program within the next decade will depend on the assistance which can be enlisted from America is probably strictly true. We have grave doubts, however, whether this or any other material amount of American capital can be coaxed into Russia until both its ideals and its practice of government are radically changed. That there is a vast country of unexploited resources goes without saying. What its population now numbers heaven only knows—doubtless many millions less than a few years ago. All of this has a direct bearing on the possibilities of such rehabilitation as would justify American capital in taking a chance. At present the situation looks to us more like poker than investment.

# Third Step in Development of Pit River Reaches Completion



ON SEPTEMBER 30 the 70,000-kw. Pit River No. 1 power house of the Pacific Gas & Electric Company was formally placed upon the power lines of California. This is the third unit of seven in a development on the Pit River which will eventually bring in 600,000 hp. It is unique among hydro-electric power developments of the West in that the source of water supply is so constant month in and month out that no water storage is necessary. Power is generated at 11,000 volts and is stepped up to 110,000 volts temporarily. Later it is proposed to raise this voltage to 175,000 volts and by the first of the year to 220,000 volts. Interesting among the features of this installation are the vertical turbine units (the second largest of their kind in the world), the long stretch of transmission line which extends almost due north and south for a distance of 250 miles, the world's record voltage of 220 kv., and the size of the great substation at Vaca, which ranks as the largest terminal substation yet constructed.

Great as is this triumph of engineering, its economic value to the section of the nation it serves is of far more value.

# Air-Break Switches Reduce Maintenance

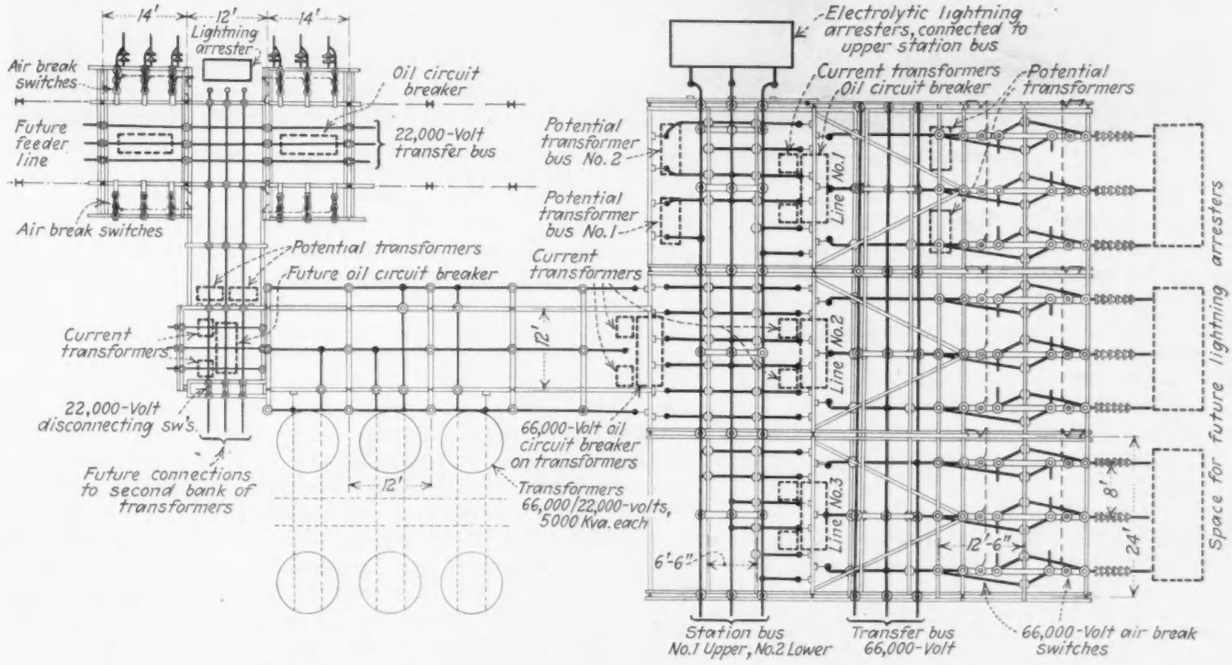
## Richland Public Service Company Avoids Duplicate Oil Switches and Uses the Air-Break Type—Provisions in Outdoor Substation for Future Additions at No Present Investment Cost

By H. E. HOADLEY
*Chief Engineer Richland Public Service Company*

TO DETERMINE how far the designer can go in laying out a large substation for an important interconnection point in providing facilities for switching and protection of apparatus without running into an unnecessary expense has always proved a puzzling question. The Richland Public Service Company, in facing the problem of how a substation at Mansfield, Ohio, was to take care of the transformation of energy from the transmission voltage of 60 kv. to the prevailing distribution voltage of 22 kv. that prevails in the greater part of the Mansfield district, selected the outdoor type. Although most of the 60-kv. transmission lines come from the plants of the company, one line now represents an interconnection with a foreign company, and it is expected that future developments will call for more foreign lines, representing other interconnections.

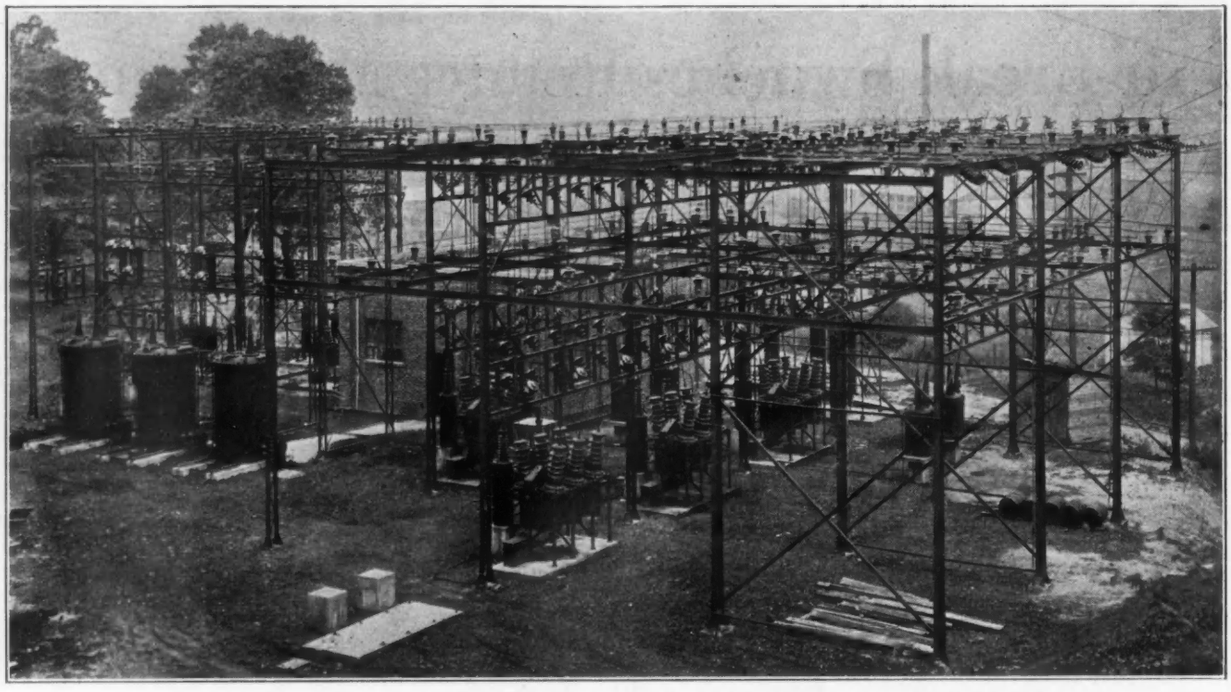
Consideration of the type of station revealed the probable cost of an indoor type of station at approximately double the cost of an outdoor type to provide the same facilities. The cost of the outdoor equipment was not only attractive, but offered opportunity to make extensions for future demands much more readily than the indoor type. These considerations influenced the choice of the outdoor type of construction, with a small house to protect the switchboard and the operating force.

The present installation comprises three 5,000-kva., single-phase transformers between the 66-kv. incoming lines and the 22-kv. outgoing lines, all of which are three-phase. Space is provided at the present time for three incoming and two outgoing lines. By reference to the plan it will be seen that the steel structures are so arranged that additions can be made without any disturbance of the existing installation, except such shutdowns as may be necessary to connect the old and new lines. The existing structure is a unit in itself, and it has not been necessary to spend money to provide for future developments except to provide land space to meet any demand that can be reasonably expected.




OUTDOOR SUBSTATION DESIGNED TO TAKE CARE OF PRESENT LOAD WITH SPACE PROVIDED TO MAKE EXTENSIONS AS NEEDED

The incoming 66-kv. bus structure is arranged so that, if necessary, duplicate oil switches for the high-tension lines can be provided, but the expenditure for such equipment was not warranted by the present demands and the arrangement shown in the wiring diagram was employed to avoid the use of duplicate oil switches and at the same time give full opportunity for inspection and maintenance of the oil switches installed. Normally the station is operated with an oil switch in each line, but in emergencies any incoming 66-kv. line can be thrown onto any other line through the transfer bus by manipulation of the air-break switches. This means the placing of two lines on one oil switch, but as such use will be for maintenance



A SIMPLE STEEL STRUCTURE PROVIDES MAXIMUM OPPORTUNITIES FOR MAINTENANCE AT ABOUT HALF THE COST OF AN OUTDOOR STATION

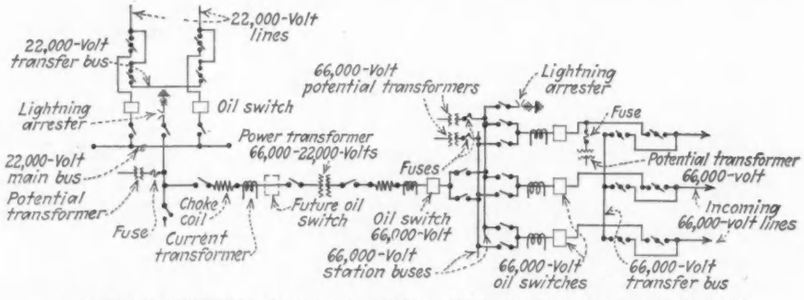
purposes during the light-load hours of the day, except in cases of extreme emergency such as those due to sudden failure of an oil switch, there is no reason why difficulties should arise from the arrangement. A double 66-kv. station bus is provided for maintenance purposes, and the incoming lines can be switched from one to the other by air-break switches. In all of these operations the 66-kv. circuits will be synchronized through the oil switches, and the air-break will be used for transfer purposes without being called on to break load.

At the present time, as there is only one transformer bank, an air-break switch has been used between the transformers and the main 22-kv. bus. With the addition of another transformer bank a 22-kv. switch will be used for the protection of each bank. The outgoing circuit switches are ample protection for the present. Each outgoing 22-kv. circuit is equipped with an outdoor oil switch, transfer bus and air-break switch similar to the 66-kv. lines.

In the selection of lightning arresters it was not believed necessary to provide arresters for each individual line. However, space is provided for their installation if future operation proves it advisable. Electrolytic arresters were therefore arranged as shown on each of the main operating buses. Choke coils are provided on each side of the transformer bank. Each arrester is supplied with a disconnecting switch between it and the bus so that the equipment can be cut if necessary. A bypass protective device consisting of two gaps in multiple, one a vacuum gap, the other a knurled air gap, with a resistance in series with both gaps, is mounted across the primary terminals of each 66-kv. current transformer.

The steel structure is simplified as far as possible. Built-up members, particularly large latticed girders, are avoided as far as possible with the result that a compact structure having ample clearance is obtained. The supports are expanded metal poles, and the other members are largely of channel and I-section.

The switch house is a one-story brick building with a concrete roof and contains panels for the control of the lines and the transformer bank. It is divided into three rooms, storeroom, washroom and operating room. The operating room contains the load dispatcher's desk, telephone and main switchboard. A panel is provided for each feeder and transformer bank, and a mimic bus extending the length of the board shows completely the switching and bus arrangement. Each oil switch is controlled from the panel by a nickel-iron-alkaline battery. All control wires enter the building in iron conduits in a concrete trench which extends the full length of the board in the rear. The control wires end on terminals mounted on a hard-wood strip at the base of the panel supports, where they are tagged and connect to panel wiring. Each feeder is protected by overload induction relays, and each of the two parallel lines at 66 kv. from the company's generating station 12 miles (19 km.) away is equipped with reverse-power relays.




AIR-BREAK SWITCHES MAKE IT POSSIBLE TO CUT OUT THE OIL SWITCHES FOR MAINTENANCE PURPOSES

# Business Trend from Energy Consumed

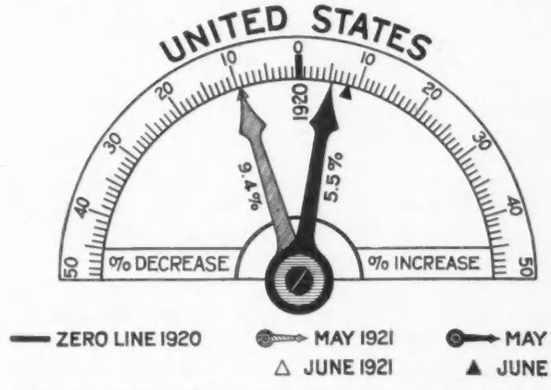
## Electrical Energy Generated by Public Utility Companies Has an Important Bearing on the Study of General Business Conditions — Practical Applications Showing Its Value for This Purpose

By THEODORE DWIGHT
*Society for Electrical Development, Inc.*

JUST as adequate electric power determines the industrial growth and prosperity of many cities and towns, so also does the prosperity of the electric light and power companies act as a guide to the study of business conditions, for electricity is utilized from coast to coast and the extent of this use is a gage of activity. Its employment is, indeed, a more reliable index than are the conditions in specific industries or the large financial movements more generally studied and analyzed. For instance, studies of existing conditions and of prospects for business as customarily made—the market for iron and steel, the volume and value of crops, the securities market, the borrowing rate for money, the bank clearings, etc.—are often merely local in their scope.

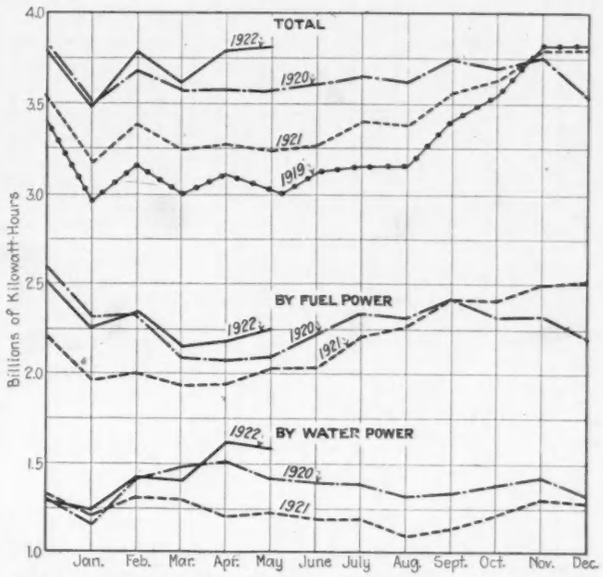
Three factors must be carefully considered in the application of electrical energy statistics to the study of general business conditions: (1) The electric light and power industry has made vast strides both in number of customers and in energy production during the past two years; (2) from certain states a certain amount of energy is exported, and (3) the government figures of energy generated include the output of electric railway generating plants as well as of light and power plants. These factors should be taken into account in the study of general business conditions based upon energy consumption, although the last two factors influence individual states rather than the sections into which the country has been arbitrarily divided.

In the accompanying chart the ten divisions are arranged so far as practicable in groups representing similar industries or natural resources. The figures for




A DECIDED UPWARD TREND SHOWN IN THE COUNTRY AS A WHOLE

June—indicated by the small triangles, white for 1921, black for 1922—show the strong "comeback" due to the improved market for textiles in certain states and groups. With a knowledge of dominating products in these groups, a study of the tabulated facts and figures will give an explanation of existing or portending conditions.




CHARACTERISTICS OF MONTHLY ELECTRICAL ENERGY OUTPUT FOR PUBLIC UTILITIES, AS COLLECTED BY THE UNITED STATES GEOLOGICAL SURVEY

Take the states of Utah and Montana—both largely dependent on mining and stock-raising. In Utah mining is largely of low-grade copper ore and lead. Montana produces much copper from higher-grade ores and also mines silver, gold and zinc. Montana has "come back" more quickly than Utah because of its higher grade of copper and its electrolytic refining. Utah's stock-raising has been affected by the low price of wool and the advanced freight rates, making the marketing of products difficult.

Hydro-electric power has been the great developer of California and the other Pacific Coast States, and this has more than offset the effect of the general business depression in 1921. The same explanation applies to other states which possess cheap power. Attention might also be drawn to the improvement in states with large agricultural interests. This is shown in Divisions 7 and 8 of the chart. The improvement in the iron and steel industry is clearly shown by the improved conditions in Pennsylvania, Minnesota, Michigan and Alabama. Oil and agriculture have helped to better conditions in Oklahoma and Texas, and mining has been a factor in Arizona, Nevada and Michigan, the latter state being helped also by general increased building, which has improved the market for lumber.

Combining these divisions and considering the United States as a whole, an excellent picture is presented.

# Electrical Energy Generated in Public Utility Plants by Water and Fuel Power During May, 1920, 1921 and 1922

| States and Sections | Population | Assessed Valuation State (Thousands) | Electrical Energy Generated in Public Utility Plants of State and Section (Thousands of Kilowatt-Hours) | | | | | | | | | | Leading Resources and Industries |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | May, 1920 | | | May, 1921 | | | | May, 1922 | | | |
| | | | By Water Power | By Fuel Power | Total Energy Generated | By Water Power | By Fuel Power | Total Energy Generated | Per Ct. Gain Over May, 1920 | By Water Power | By Fuel Power | Total Energy Generated | Per Ct. Gain Over May 1920 | |
| **United States:** | 105,273,049 | | 1,524,682 | 2,054,965 | 3,579,647 | 1,322,438 | 1,919,415 | 3,241,853 | —9.40 | 1,626,711 | 2,149,910 | 3,776,621 | 5.50 | |
| Division 1 | 7,400,909 | | 132,250 | 164,490 | 296,740 | 102,209 | 146,694 | 248,903 | —16.10 | 122,994 | 156,818 | 279,812 | —5.70 | Waterpower, textiles, manufacturing, shoes, paper, commerce |
| Division 2 | 22,261,144 | | 312,686 | 659,210 | 911,896 | 218,918 | 649,031 | 867,949 | —10.70 | 323,558 | 719,519 | 1,043,077 | 7.30 | Manufacturing, agriculture, iron and steel, mining, textiles, commerce |
| Division 3 | 7,862,182 | | 19,552 | 158,191 | 177,743 | 24,658 | 160,571 | 185,229 | 4.20 | 29,836 | 180,404 | 210,240 | 18.30 | Agriculture, manufacturing, tobacco, commerce, mining |
| Division 4 | 8,107,149 | | 153,311 | 31,426 | 184,737 | 123,116 | 23,532 | 146,648 | —20.60 | 152,015 | 26,525 | 178,540 | —8.77 | Agriculture, tobacco, textiles, sugar, waterpower, cotton |
| Division 5 | 10,027,390 | | 82,180 | 51,598 | 133,778 | 62,630 | 51,559 | 114,189 | —14.60 | 70,561 | 52,661 | 123,222 | —7.70 | Lumber, cotton, tobacco, mining, manufacturing, steel |
| Division 6 | 22,247,531 | | 87,046 | 703,055 | 790,101 | 89,326 | 620,167 | 709,493 | —10.20 | 95,004 | 738,231 | 833,235 | —5.45 | Agriculture, mining, manufacturing, slaughtering, steel |
| Division 7 | 11,772,261 | | 157,113 | 124,643 | 281,756 | 156,622 | 120,516 | 277,138 | —1.98 | 177,643 | 140,436 | 318,079 | 12.70 | Agriculture, livestock, manufacturing, lumber, packing |
| Division 8 | 7,386,023 | | 11,047 | 71,454 | 82,501 | 7,520 | 80,628 | 88,148 | 6.72 | 11,453 | 86,682 | 98,135 | 18.95 | Agriculture, livestock, lumber, oil, mining |
| Division 9 | 2,641,589 | | 184,110 | 20,567 | 204,677 | 116,862 | 17,284 | 134,146 | —35.00 | 161,289 | 19,483 | 180,772 | —11.65 | Mining, stockraising, agriculture, waterpower, smelting |
| Division 10 | 5,566,871 | | 385,387 | 70,331 | 455,718 | 420,577 | 49,433 | 470,010 | 3.13 | 482,358 | 29,151 | 511,509 | 10.90 | Waterpower, agriculture, lumber, mining, manufacturing |
| **Division 1:** | | | | | | | | | | | | | | |
| Maine | 768,014 | $637,403 | 29,459 | 420 | 29,879 | 26,763 | 206 | 26,969 | —9.75 | 31,083 | 66 | 31,149 | 4.25 | Water power, lumber, paper, shipbuilding, textiles |
| New Hampshire | 443,083 | 511,457 | 20,321 | 5,632 | 25,953 | 15,665 | 1,882 | 17,547 | —32.40 | 20,321 | 2,124 | 22,445 | —13.50 | Water power, agriculture, quarrying, manufacturing, shoes, textiles |
| Vermont | 352,428 | 260,894 | 20,829 | 76 | 20,905 | 8,703 | 3 | 8,706 | —58.30 | 9,896 | 0 | 9,896 | —52.60 | Tobacco, textiles, shoes, manufacturing |
| Massachusetts | 3,852,356 | 7,276,334 | 42,670 | 100,762 | 143,432 | 34,815 | 92,005 | 126,830 | —11.50 | 41,522 | 98,632 | 140,154 | —2.28 | Tobacco, textiles, shoes, shipbuilding, manufacturing |
| Rhode Island | 604,397 | | 933 | 20,024 | 20,957 | 882 | 19,155 | 20,037 | —4.40 | 840 | 19,927 | 20,767 | —0.95 | Textiles, manufacturing, metals |
| Connecticut | 1,380,631 | 1,464,602 | 18,038 | 37,576 | 55,614 | 15,381 | 33,443 | 48,424 | —12.20 | 19,332 | 36,069 | 55,401 | —3.82 | Water power, tobacco, agriculture, manufacturing, copper, machinery |
| **Division 2:** | | | | | | | | | | | | | | |
| New York | 10,385,227 | 14,850,980 | 250,404 | 289,925 | 540,329 | 166,480 | 302,502 | 468,982 | —13.20 | 264,597 | 334,232 | 598,829 | 10.80 | Water power, agriculture, mining, manufacturing, commerce |
| New Jersey | 3,155,900 | 3,254,964 | 221 | 85,556 | 85,777 | 208 | 72,177 | 72,385 | —15.60 | 208 | 84,488 | 84,696 | —1.26 | Iron and zinc, agriculture, quarrying, manufacturing, textiles |
| Pennsylvania | 8,720,017 | 9,391,039 | 62,061 | 283,729 | 345,790 | 52,230 | 274,352 | 326,582 | —5.52 | 58,753 | 300,799 | 359,552 | 3.98 | Mining, steel, agriculture, manufacturing, textiles |
| **Division 3:** | | | | | | | | | | | | | | |
| Maryland | 1,449,661 | 1,555,226 | 183 | 15,294 | 15,477 | 378 | 12,991 | 13,369 | —13.60 | 289 | 16,563 | 16,852 | 8.90 | Agriculture, canning, shipbuilding, manufacturing, commerce |
| Virginia | 2,309,187 | | 16,978 | 23,715 | 40,693 | 21,708 | 22,650 | 44,358 | 9.00 | 26,252 | 27,030 | 53,032 | 30.90 | Tobacco, agriculture, lumber, shipping, manufacturing |
| Delaware | 223,003 | | 0 | 5,735 | 5,735 | 0 | 5,394 | 5,394 | —5.90 | 0 | 6,754 | 6,754 | 17.80 | Grain, fruit, manufacturing |
| West Virginia | 1,463,701 | 1,579,594 | 2,391 | 91,646 | 94,037 | 2,562 | 97,289 | 99,851 | 6.17 | 3,287 | 103,830 | 107,117 | 13.90 | Water power, mining, natural gas, agriculture |
| Kentucky | 2,416,630 | | 0 | 21,801 | 21,801 | 10 | 22,247 | 22,257 | 2.10 | 8 | 26,227 | 26,235 | 20.30 | Tobacco, agriculture, manufacturing, flour mills |
| **Division 4:** | | | | | | | | | | | | | | |
| Georgia | 2,895,832 | 1,346,883 | 39,606 | 8,744 | 48,350 | 38,678 | 6,444 | 45,122 | —6.70 | 46,983 | 5,928 | 52,911 | 9.45 | Lumber, tobacco, turpentine, fertilizer, cotton, sugar, grain |
| North Carolina | 2,559,123 | 2,579,076 | 59,674 | 9,016 | 68,690 | 24,282 | 3,149 | 27,431 | —60.00 | 31,981 | 4,415 | 36,396 | —47.00 | Water power, grain, textiles, sugar, tobacco |
| South Carolina | 1,683,724 | 448,223 | 53,097 | 4,202 | 57,299 | 59,428 | 3,341 | 62,769 | 9.56 | 72,520 | 3,637 | 76,157 | 32.90 | Water power, agriculture, cotton, tobacco, grain, textiles |
| Florida | 968,470 | | 934 | 9,464 | 10,398 | 728 | 10,598 | 11,326 | 8.90 | 531 | 12,545 | 13,076 | 25.50 | Agriculture, lumber, turpentine, phosphates, fruits |
| **Division 5:** | | | | | | | | | | | | | | |
| Tennessee | 2,337,885 | 1,649,524 | 41,132 | 10,758 | 51,890 | 33,851 | 9,792 | 43,643 | —15.90 | 25,817 | 11,711 | 37,528 | —27.60 | Mining, agriculture, lumber, manufacturing |
| Alabama | 2,348,174 | 952,602 | 40,941 | 8,541 | 49,482 | 28,719 | 8,614 | 37,333 | —24.60 | 44,610 | 6,877 | 51,487 | 4.05 | Water power, mining, steel, manufacturing |
| Mississippi | 1,790,618 | 765,198 | 0 | 5,770 | 5,770 | 0 | 4,912 | 4,912 | —12.10 | 0 | 4,624 | 4,624 | —19.20 | Tobacco, grain, cotton, lumber |
| Arkansas | 1,752,204 | | 107 | 8,426 | 8,533 | 60 | 8,997 | 9,057 | 6.50 | 134 | 9,311 | 9,445 | 10.80 | Agriculture, rice, cotton, grain |
| Louisiana | 1,798,509 | 1,698,564 | 0 | 18,103 | 18,103 | 0 | 19,244 | 19,244 | 6.34 | 0 | 20,138 | 20,138 | 11.20 | Sulphur, cotton, lumber, sugar, shipping, tobacco |
| **Division 6:** | | | | | | | | | | | | | | |
| Michigan | 3,668,412 | 5,320,000 | 59,937 | 112,452 | 172,389 | 60,560 | 94,465 | 155,025 | —10.60 | 65,914 | 112,879 | 178,793 | —3.70 | Mining, agriculture, lumber, autos, shipping |
| Ohio | 5,759,394 | 10,672,277 | 2,890 | 246,969 | 249,859 | 2,868 | 195,820 | 198,688 | —20.50 | 3,817 | 240,387 | 244,204 | 12.28 | Mining, agriculture, manufacturing |
| Indiana | 2,930,390 | | 3,465 | 67,325 | 70,790 | 4,636 | 65,767 | 70,403 | —0.50 | 6,507 | 76,765 | 83,272 | 7.60 | Agriculture, manufacturing |
| Illinois | 6,485,280 | 8,403,631 | 15,202 | 226,835 | 242,037 | 15,663 | 211,109 | 226,772 | —6.30 | 15,853 | 246,174 | 262,027 | 18.25 | Mining, agriculture, slaughtering, steel, manufacturing |
| Missouri | 3,404,055 | 4,920,926 | 5,552 | 49,474 | 55,026 | 5,599 | 53,006 | 58,605 | 6.48 | 2,913 | 62,026 | 64,939 | 8.00 | Mining, agriculture, cotton, tobacco, slaughtering |
| **Division 7:** | | | | | | | | | | | | | | |
| Minnesota | 2,387,125 | 2,084,287 | 38,676 | 8,220 | 46,896 | 43,484 | 11,046 | 54,530 | 16.25 | 46,829 | 11,673 | 58,502 | 24.80 | Mining, agriculture, lumber, manufacturing |
| Iowa | 2,404,021 | | 59,291 | 25,505 | 84,796 | 54,363 | 27,677 | 82,040 | —4.36 | 63,097 | 29,541 | 92,638 | 7.95 | Agriculture, livestock, packing, manufacturing |
| Wisconsin | 2,632,067 | | 54,306 | 36,933 | 91,239 | 53,434 | 29,791 | 83,225 | —8.75 | 62,243 | 40,762 | 103,005 | 12.86 | Wheat, flour mills, lumber, shipyards, manufacturing |
| North Dakota | 646,872 | 1,377,916 | 0 | 1,855 | 1,855 | 0 | 2,023 | 2,023 | 9.50 | 0 | 2,061 | 2,061 | 11.00 | Agriculture, livestock, wheat |
| South Dakota | 636,547 | 2,064,602 | 1,412 | 2,377 | 3,789 | 1,589 | 2,298 | 3,887 | 2.50 | 1,648 | 2,614 | 4,262 | 12.45 | Mining, livestock, wheat, milling, dairying |
| Nebraska | 1,296,372 | | 987 | 19,032 | 20,019 | 1,477 | 19,254 | 20,731 | 3.55 | 1,476 | 21,480 | 22,956 | 14.60 | Livestock, lumber, wheat, packing |
| Kansas | 1,769,257 | | 2,441 | 30,721 | 33,162 | 2,275 | 28,427 | 30,702 | —7.40 | 2,350 | 32,305 | 34,655 | 7.50 | Live stock, grain, packing, manufacturing |
| **Division 8:** | | | | | | | | | | | | | | |
| Oklahoma | 2,028,283 | | 143 | 17,276 | 17,419 | 265 | 15,773 | 16,038 | —7.93 | 166 | 19,663 | 19,829 | 13.80 | Oil, agriculture, lumber |
| Texas | 4,663,228 | 3,370,470 | 310 | 48,094 | 48,404 | 372 | 59,944 | 60,316 | 24.60 | 379 | 62,880 | 63,259 | 30.60 | Oil, lumber, livestock, cotton, grain, tobacco, sugar |
| New Mexico | 360,350 | 363,722 | 82 | 1,162 | 1,244 | 73 | 1,211 | 1,284 | 3.22 | 56 | 1,345 | 1,401 | 12.60 | Agriculture, cattle |
| Arizona | 334,162 | | 10,512 | 4,922 | 15,434 | 6,810 | 3,700 | 10,510 | —31.80 | 10,852 | 2,794 | 13,646 | 18.95 | Cattle, mining, agriculture |
| **Division 9:** | | | | | | | | | | | | | | |
| Montana | 548,889 | | 95,245 | 506 | 95,751 | 42,270 | 587 | 42,857 | —54.00 | 81,488 | 571 | 82,059 | —14.00 | Water power, mining, smelting |
| Wyoming | 194,402 | 438,150 | 179 | 3,746 | 3,925 | 140 | 2,722 | 2,862 | —27.00 | 117 | 2,753 | 2,870 | —27.00 | Stockraising, agriculture |
| Colorado | 939,629 | 1,578,814 | 15,428 | 16,111 | 31,539 | 15,762 | 3,548 | 29,310 | —7.03 | 15,641 | 15,949 | 31,590 | 1.60 | Water power, mining, agriculture, stockraising |
| Utah | 449,396 | 688,000 | 13,955 | 6 | 13,961 | 7,754 | 0 | 7,754 | —44.30 | 4,493 | 35 | 4,528 | —67.50 | Mining, smelting, agriculture, livestock |
| Nevada | 77,407 | | 2,646 | 73 | 2,719 | 3,081 | 25 | 3,106 | 14.20 | 3,310 | 32 | 3,342 | 22.90 | Mining |
| Idaho | 431,866 | 506,603 | 56,657 | 125 | 56,782 | 47,855 | 402 | 48,257 | —15.0 | 56,240 | 143 | 56,383 | —7.05 | Water power, mining, agriculture, sheep raising |
| **Division 10:** | | | | | | | | | | | | | | |
| Washington | 1,356,621 | 1,177,239 | 94,819 | 2,348 | 97,167 | 88,536 | 2,177 | 90,713 | —6.65 | 101,595 | 1,968 | 103,563 | 6.57 | Water power, grain, stock raising, fisheries, flourmilling, shipbuilding |
| Oregon | 783,389 | 1,020,804 | 32,042 | 7,026 | 39,068 | 33,314 | 3,449 | 36,763 | —8.45 | 32,951 | 5,224 | 38,175 | —2.28 | Water power, lumber, agriculture |
| California | 3,426,861 | 4,929,480 | 258,526 | 60,957 | 319,483 | 298,727 | 43,807 | 342,534 | 7.20 | 347,812 | 21,959 | 369,771 | 15.80 | Water power, lumber, agriculture, mining, manufacturing |

Taking conditions as of May for the three years, the index of reference being as before the situation in 1920, the conditions in May, 1921, when the output of the nation's electric light and power companies was 9.4 per cent below that of the corresponding period of the index year, indicates a material drop in business activities. By May, 1922, however, the index of business is shown swinging over to the other side of the scale, registering a betterment over 1920 output of 5.5 per cent.

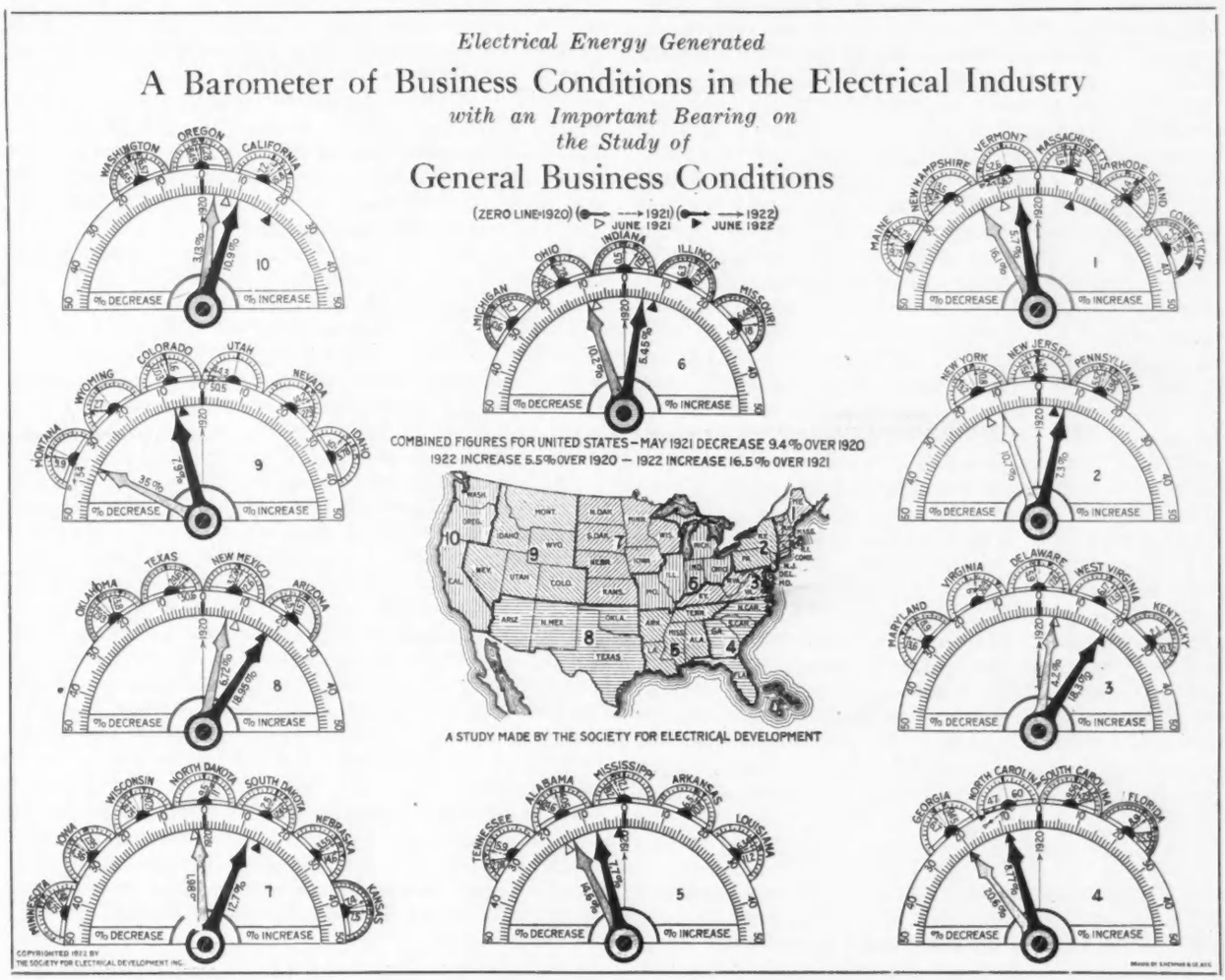
The June conditions show even a more gratifying trend, for the electrical output in June, 1921, was 9.2 per cent below that for June, 1920—a slight improvement over the situation in the corresponding months of May, indicating that a slow but positive improvement had commenced even in 1920. By June, 1922, the betterment is seen to have become quite marked, for not only is the betterment for the months of May equaled, but the index points to a gain of 8.2 per cent above the 1920 balance.

During the latter part of 1921 the output of the central stations rose slowly and steadily as conditions commenced to improve until at the commencement of the current year it was within 1 per cent of the banner year of 1920. This gain was almost entirely due to increased domestic business on the part of the central stations, and therefore it was not so promptly felt in betterment of business as a corresponding increase in industrial demand would have been. Since the first of the year, however, there has been a steady resumption of industrial activity, the latest available records showing that, following a drop of about 0.5 per cent in January, the increase in central-station output is 10 per cent higher than for the corresponding period of 1920.

### While Electrical Output Is Maintained Depression Cannot Return

Just as surely as the 10 per cent drop during 1921 indicated depression, the 10 per cent increase indicates prosperity. The most sensitive of gages has registered, and depression cannot return before there is a decided slowing down of the central-station generation, a process which would take considerable time.

The accompanying diagram showing central-station output in the United States by months for the years 1919, 1920, 1921 and 1922, emphasizing the deductions made above and the comparison of the amounts produced by water power and fuel, brings out clearly the fact that there was a big drop in 1921 in the consumption of electric energy produced by water power, which is used largely for industrial power, but a distinctly rising market for energy produced by fuel. The addition of a million (or 12.5 per cent) to the number of domestic consumers during the year, with an increased use for electrical appliances in the homes, explains in large part the quick rise in the latter half of the year.


Electrical Energy Generated
A Barometer of Business Conditions in the Electrical Industry
with an Important Bearing on the Study of
General Business Conditions
(ZERO LINE=1920) 1921 JUNE 1921 1922 JUNE 1922
COMBINED FIGURES FOR UNITED STATES—MAY 1921 DECREASE 9.4% OVER 1920
1922 INCREASE 5.5% OVER 1920 — 1922 INCREASE 16.5% OVER 1921
A STUDY MADE BY THE SOCIETY FOR ELECTRICAL DEVELOPMENT
% DECREASE
% INCREASE
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# Relative Merits of Mine Locomotives*

## Larger-Capacity Straight-Battery Type Might Show Rate 2 Cents a Ton Lower than Combination — Reel Type Fits Heavy, Combination Fits Medium, and Straight-Battery Fits Low Grades

WIDELY differing experiences have been reported by mining and electrical engineers discussing the merits of different kinds of gathering locomotives. This variance is attributed to the fact that much of the equipment has been misapplied and the individuals responsible have refused to acknowledge their mistakes. With the hope of correcting any wrong impressions which have thus arisen, some facts will be brought out here that should make it possible to assign the straight storage-battery, the combination and the conductor-reel gathering locomotives each to its most economical field of application. The statements and data are based on extremely accurate cost records kept by the Logan (W. Va.) Mining Company since March 1, 1920. In the comparisons made, nineteen gathering locomotives are considered. Nine are combination machines equipped with eighty-eight-cell lead batteries, all thirteen-plate except one, which is fifteen-plate; seven are of the straight forty-eight-cell storage-battery type, two being seventeen-plate, three nineteen-plate and two twenty-one-plate; three locomotives are conductor cable-reel type. The coal beds are generally considered level but have numerous dips ranging up to 4 per cent.

The largest item of cost is for the wages of motormen and brakemen. The average wage these operatives received during the period under consideration was $5.59 per eight-hour day, the mines working 404.5 eight-hour shifts during this time. The next important item is the power-demand charge, which in this locality is based on the highest integrated five-minute peak that occurs during a month. This charge is $1.80 per kilowatt per month, and to it the regular charge for energy must be added. By the use of straight storage-battery locomotives this demand charge is at a minimum, hence the straight-battery machine is taken for a base.

### Allocation of Demand Charges

Accordingly the cable-reel-locomotives must be charged with a demand equal to the capacity of their motors, which is 30 kw., as they all draw their power from the trolley and do it during the day shift, when the maximum load is on. The motor capacity of the combination locomotives is 20 kw. Apparently they should be charged with 20 kw. of demand, but as they operate from the trolley only 20 per cent of the time they rarely ever all draw their maximum capacity from the system at the same time. Consequently they are charged with 75 per cent of their capacity, which is 15 kw. per locomotive per month.

Reel and combination locomotives are charged with increased copper, trolley hangers, bonds and labor for bonding butt entries, but these charges are spread over the total tonnage of a 1,000-ft. x 300-ft. panel in a 5-ft. seam with 80 per cent recovery. The maintenance cost of the wire and bonding is not considered, as it will just about offset the value of this material when the entry or panel is worked out. But there is another charge of like nature. It is well known that if cable-reel or combination gathering locomotives are being used more substation capacity and more copper in the whole transmission system are required because a greater percentage of the total power consumption is being used in a shorter period than would be the case where straight storage-battery machines were being employed. Hence these two charges must be made against these two types of locomotives. They are divided between them in about the same proportion as the demand charge, but they are based on the total tonnage of an average-size lease or mine.

Another claim or charge must be made against the cable-reel gathering locomotive; this is the loss caused by power failure or interruption. When there is such failure the whole mine comes to a dead stop almost instantly, so far as the moving or transportation of coal to the tipple is concerned. Still, a major portion of the operating expenses continue.

The power company's record in this locality from a time standpoint shows 98 per cent supply. This means that during 2 per cent of the time no power is available at the mines. This is a pretty fair degree of service. But it also means that on an average during 28.8 minutes out of every twenty-four hours no power is available. It is reasonable furthermore to believe that 75 per cent of this failure will come during the eight-hour working shift, because this is the period of heaviest load. This being the case, the period when power is lacking averages 21.6 minutes during each working shift, or is equivalent to 4.5 per cent of the working time.

Assuming the average cost of production as being about $1.75 per ton, allowing for the fact that power failure would not be particularly injurious when coal is not being produced and allowing for contingencies, the charge entered against the reel-type gatherer is 1.75 cents per ton.

A battery locomotive could not continue its work over any protracted period of time should the power not be restored, because the mine cars would all be filled and because the mine could not continue to operate without ventilation, but the records show that the average duration of these failures is fifteen to twenty minutes. It is obvious that with storage-battery locomotives these short interruptions are scarcely felt, as the main-haulage locomotives and tipples almost always have a surplus of capacity sufficient to overcome these short delays, provided that the loaders at the working face are kept going.

Another consideration in connection with power failure, not convertible to figures but nevertheless pronounced in its effect on cost, is the fact that miners are difficult to hold in a mine when they fail to receive cars promptly, consequently a power failure of thirty min-

*Abstract of report of committee on the relative merits of storage-battery, combination and conductor-cable-reel gathering locomotives, presented Sept. 20 at the meeting of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers, by C. E. Rogers, chairman.

utes in the afternoon often leaves a mine badly crippled for the remainder of the shift. To those who closely watch the daily cost statements of a mine the effects of such happenings are often noticeable to the extent of 25 cents or 30 cents per ton.

The data given in Table I show that the straight-storage-battery locomotives have an advantage of 0.07 cents per ton over the combination machines. Although this is correct, if we stop here we shall not do justice to the straight-battery locomotive; therefore Table II, showing the comparative capacity of the two, is presented.

From this it may be seen that the combination machine drawing 20 per cent of its power from the trolley has a battery equivalent of 44.23 kw.-hr., which gives it an advantage of 35 per cent in capacity over the straight-battery locomotive. The table of percentage shows that the combination has led the straight-battery machine by only 28 per cent in tonnage, notwithstanding its 35 per cent advantage in capacity.

This difference in tonnage cannot be traced to anything but a difference in capacity resulting from the fact that the mileage rating of both types of locomotives under consideration is the same when operating from the batteries, but the combination has 42 per cent advantage in speed over the straight-battery machine while operating from the trolley, provided that 250-volt pressure is maintained on the section from which cars are being gathered. This latter condition is possible but not practical, consequently we drop this apparent advantage and assume that the straight-battery machine equipped with the same capacity as the combination locomotive will gather the same tonnage under the conditions being considered. This would require about a twenty-seven-plate instead of a nineteen-plate battery, which is approximately a 50 per cent increase.

If we go back to the data in Table I referring to the seven straight-battery locomotives and increase the battery depreciation 50 per cent and the repair cost and tonnage 28 per cent, based on the combination tonnage, while the operating cost remains the same, it will give the results set forth in Table III, showing what the cost and tonnage figures would have been on these locomotives had they been equipped with this additional capacity.

Had the data already given in this paper been procurable at the time the above equipment was purchased Table IV could have been prepared.

By comparing the repair cost alone of the three types of locomotives the combination will seem a little high, as it has no cable cost or reel maintenance. This is due to a rather delicate equipment, originally installed in eight of these locomotives. This equipment was taken out about eight months ago and replaced with a later and more rugged type, which has already lowered the maintenance from 2.51 cents per ton to 2.11 cents over the whole time period of twenty-seven months.

Figured on the last eight months alone maintenance cost is down to 1.42 cents per ton. This is the only pronounced advantage that the cable-reel locomotive has had over the combination machine in this comparison. Had the combination had this latter equipment in the beginning, the difference would have been 0.69 cent per ton more in its favor. Having been in service for many years, the design of cable-reel locomotives has reached a comparatively high state of perfection. This has been greatly in their favor in all cases where they have been called on to compete with storage-battery locomotives.

The cost of motor cable is used as a common argument by battery-locomotive "boosters" as an item sufficient just about to offset battery depreciation. This we do not believe can be verified except possibly in a few extreme cases. The average life of a cable on the locomotives for which results have just been given is eight

TABLE I—RELATIVE MERITS OF COMBINATION, STRAIGHT BATTERY AND CONDUCTOR-CABLE-REEL LOCOMOTIVES

TONNAGE DATA

| Locomotives | Total Tons | Tons per Locomotive | Tons per Locomotive per Eight-Hour-Day |
|---|---|---|---|
| Nine combination | 735,543 | 70,615.9 | 174.6 |
| Seven straight-battery | 355,852 | 50,836.0 | 125.7 |
| Three conductor-cable-reel | 150,307 | 50,102.3 | 123.9 |
| Total | 1,241,702 | 60,089.6 | 148.6 |
| Percentage | | | |
| Combination | | | 100.00 |
| Straight-battery | | | 71.99 |
| Cable-reel | | | 70.96 |

COST DATA ON NINE COMBINATION LOCOMOTIVES

| | | Cost per Ton, Cents |
|---|---|---|
| Total repair cost | $13,431.49 | 2.11 |
| Total battery depreciation | 19,774.50 | 3.11 |
| Increased power demand, 15 kw. x $1.80 x 9 x 27 | 6,565.00 | 1.03 |
| Increased cost of wire and of bonding butt entries | 1,334.64 | 0.21 |
| Increased substation capacity | 254.22 | 0.04 |
| Increased main feeders and main-line bonding | 63.55 | 0.01 |
| Operating cost, 404.5 days at $5.59 x 2 x 9 | 40,700.79 | 6.40 |
| Total | $82,124.19 | 12.91 |

COST DATA ON SEVEN STRAIGHT-STORAGE-BATTERY LOCOMOTIVES

| | | |
|---|---|---|
| Total repair cost | $3,657.75 | 1.03 |
| Total battery depreciation | 10,385.10 | 2.92 |
| Operating costs 404.5 days at $5.59 x 2 x 7 | 31,656.17 | 8.89 |
| Total | $45,699.02 | 12.84 |

COST DATA ON THREE CONDUCTOR-CABLE-REEL LOCOMOTIVES

| | | |
|---|---|---|
| Total repair cost | $3,394.78 | 2.26 |
| Increased power demand, 30 kw. at $1.80 x 3 x 27 | 4,381.29 | 2.91 |
| Increased cost of wire and of bonding butt entries | 1,608.28 | 1.07 |
| Increased cost of main feeders and main-line bonding | 90.18 | 0.06 |
| Increased substation capacity | 270.55 | 0.18 |
| Cost arising from power interruptions | 2,630.37 | 1.75 |
| Operating cost, 404.5 days at $5.59 x 2 x 3 | 13,566.93 | 9.03 |
| Totals | $25,942.38 | 17.26 |

AGGREGATE COST DATA ON NINETEEN LOCOMOTIVES

Total tons 1,141,702; Total cost $153,765.59; Average cost per ton 13.47c.

ADVANTAGES

| | |
|---|---|
| Battery over combination, 0.07c. per ton, saving on above tonnage | $799.19 |
| Battery over reel type, 4.42 cents per ton, saving on above tonnage | 50,463.23 |
| Combination over reel type, 4.35 cents per ton, saving on above tonnage | 49,664.04 |

TABLE II—CAPACITY OF COMBINATION AND STORAGE-BATTERY LOCOMOTIVES

| | Cells | Plates | Total Positive Plates | Kw.-Hr. Capacity, Six Hours |
|---|---|---|---|---|
| Combination | 88 | 13 | 528 | 35.38 |
| Straight battery | 48 | 19 | 432 | 28.94 |

TABLE III—TOTAL TONS INCREASED BY 38.9 PER CENT, OR FROM 355,852 TO 494,278

| | | Cost Per Ton, Cents |
|---|---|---|
| Total repair cost increased by 38.9 per cent, or from $3,657.75 to | $5,080.54 | 1.03 |
| Total battery depreciation increased by 50 per cent or from 10,385.10 to | 15,577.65 | 3.15 |
| Operating cost remaining the same | 31,656.17 | 6.40 |
| Total | $52,314.36 | 10.58 |

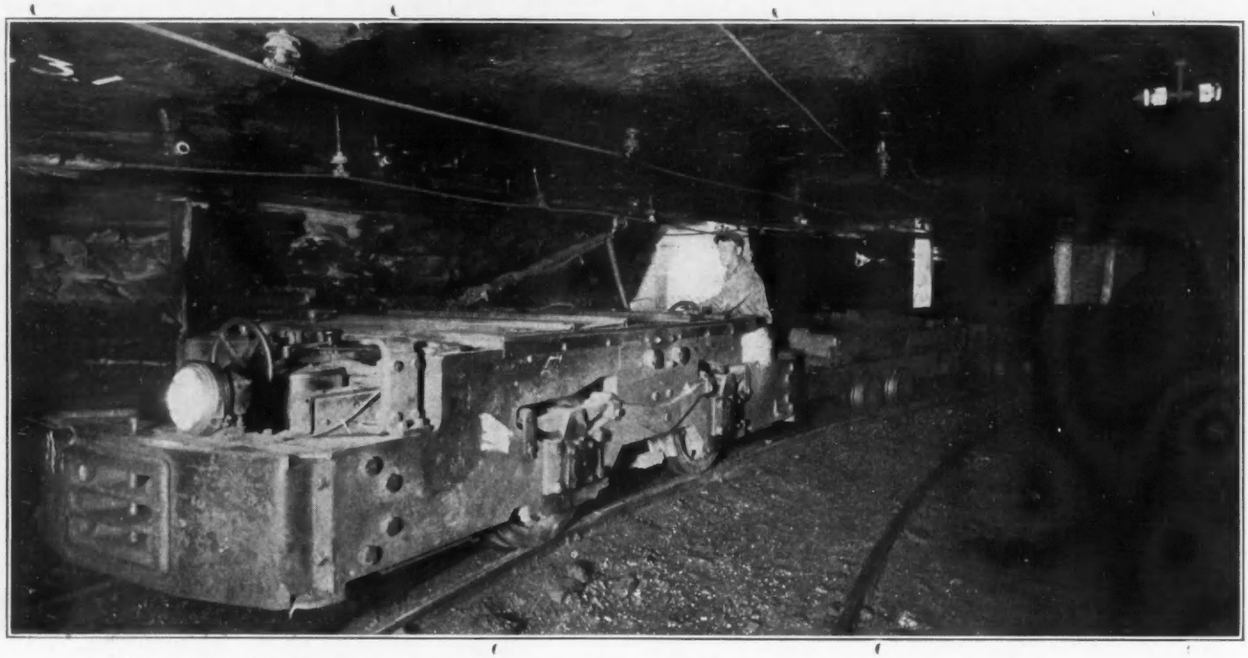
TABLE IV—RELATIVE MERITS OF STORAGE-BATTERY, COMBINATION AND CONDUCTOR-CABLE-REEL GATHERING LOCOMOTIVES

| | |
|---|---|
| Advantage of straight-battery locomotives: | |
| Over combination, 2.33 cents per ton; saving on total tonnage | $26,601.66 |
| Over reel type, 6.68 cents per ton; saving on total tonnage | 76,265.69 |

months. Worked out in cost per ton it stands at about 0.3 cent, compared to battery depreciation of 2.92 cents and 3.11 cents per ton.

The straight storage-battery locomotive has a clear advantage over both the other types in maintenance cost, and it is not likely that either of them will ever be able to compete with it in this particular. Its entire electrical circuit is insulated from the ground. There is thus no difference in potential between the motor windings and the frame, and for this reason the tendency to ground is eliminated.

Moreover, as the straight-storage-battery locomotive has its whole source of power on its back and is not subject to transmission troubles or losses, the electrical equipment is designed for a much lower voltage than the combination or reel type. This, in addition to the double insulating feature, almost entirely eliminates electrical trouble. Records show that the number of such troubles with this kind of locomotive compared with that of the other types is about in the ratio of one to twelve.



THE MINE LOCOMOTIVE HAS MADE POSSIBLE A GREAT REDUCTION IN THE PRODUCTION COST OF COAL

This brings in another important point of merit for which for want of more definite data this locomotive receives no credit in the tabulation. What does it mean to have a locomotive in the middle of the shift come hauling in another that is incapacitated from a burnout?

It means that one locomotive is taken from its work for at least fifteen or twenty minutes while the cost on that section goes right on. The other machine is out probably for the rest of the day; the miners on its section go home; the day is finished with 50 or 100 tons of coal short, yet with no curtailment of the day's expense. These are the things that really count when it comes to considering the relative merits of various types of equipment.

The lower voltage of the straight-storage-battery machine gives it another advantage over the combination type from the battery point of view. The first cost of the battery is less per kilowatt-hour of capacity because of the smaller number and the larger size of the cells. This reduced number of cells and lower voltage reduce the battery maintenance cost, there being fewer cells to keep up and less tendency for grounds and leakage due to lower voltage and a completely insulated battery circuit. From this company's records this consideration seems to have netted 12½ per cent longer life on this battery. Of course, this is all worked into the data given, and it also is noticeable to the extent of 0.19 cent per ton on the battery depreciation, notwithstanding the fact that the combination locomotives did 20 per cent of their work from the trolley.

Another misfortune that to some extent has held down the tonnage of the straight-battery machine is that it did not have sufficient battery capacity even to get a chance in competing with the combination locomotive for the larger producing territories.

It seems that the greatest disadvantage of the reel type of locomotive lies in its inability to compete with the battery machine in tonnage under average gathering conditions. This is due to a number of considerations, chief among which are power interruptions or failures from various causes, cable and reel troubles, inconveniences of changing from trolley to cable, and vice versa.

In considering efficiency from a power standpoint it is generally thought that the cable-reel locomotive is more efficient than the battery. We do not believe there is much difference in the controllers of the two types of machine as the loss in a battery usually just about equals the line drop sustained in the other type. But from the controller to the rails sufficient reason exists to believe that the battery considerably leads the other type. In the first place, the reel type almost always has a higher mileage rating, which tends to give quicker acceleration but which at the same time results in considerably more slippage, thereby consuming energy uselessly.

Under the same conditions the reel type must necessarily operate with more resistance in the circuit than the battery machine. Another argument in the same direction is that in almost every case where the oper-

ator is changed from a reel-type to a battery locomotive, he "kills" the battery on much less tonnage than the old operator who has learned to save through a realization that his supply of energy is limited. There is no question that a battery teaches economy in this respect. If an accurate test were made the storage-battery locomotive would probably show about 40 per cent more efficiency than the cable-reel type.

The place for the cable-reel type is down over the hill, that for the combination just over the brink a little, and that for the straight battery on top of the hill. If they will stay in their respective places, there should be no trouble or argument, but if the battery goes down over the mountain it can expect to be run out by the cable-reel locomotive, or if the cable-reel persists in coming up or staying on the level, it will be put out of business by the battery machine. In like manner the combination must not go too far over the hill or try to cover too much of the top. This designates an economical place for each of the types of gathering locomotives, and it is doubtful whether there is a single large mine in the country that should not have just such a mixture of equipment.

An example of the effect on the cost of production of such record keeping over a period of twenty-seven months divided into three periods of twelve, eight and seven months is presented in Table V. Had it not been for the record keeping, the cost would have continued somewhere near that of the first year, and if so the total outlay on the above tonnage would have been $81,624.26 instead of $55,791.27. This shows a net saving of $25,832.99, or approximately $1,000 per month.

TABLE V—HOW MAINTENANCE AND BATTERY DEPRECIATION COSTS DECLINED AFTER KEEPING COST RECORDS

| | Tons Moved | Cost | Cost per Ton Cents |
|---|---|---|---|
| First twelve months | 505,300 | $29,435.33 | 5.83 |
| Next eight months | 476,810 | 17,610.06 | 3.69 |
| Next seven months | 417,963 | 8,745.88 | 2.09 |
| Twenty seven months | 1,400,073 | $55,791.27 | 3.98 |

# Ground Relays Improve Protection

## Isolation of Accidentally Grounded Sections by Accurate Switch Operation Can Be Effected in Nearly Every Case by Use of Proper Combination of Protective Relays

By L. A. TERVEN
*Assistant Electrical Engineer West Penn Power Company, Pittsburgh, Pa.*

THE increasing use of three-phase transmission lines with the neutral grounded through a resistance or dead-grounded has accentuated the development of so-called ground relays. The function of these relays is to trip the proper circuit breakers or give certain alarm signals in case of a fault to ground on a line or within some piece of apparatus. The most desirable protection is given when the switches nearest the fault are tripped quickly. Ground relays are usually operated in conjunction with other relays used for overload and short-circuit protection, and meters are frequently inserted in the same secondary circuits. The tendency is to overload the instrument transformers, and each application should be carefully considered from this standpoint.

The induction type of relay is commonly considered preferable for ground relays on account of the accurate time setting possible. Selectivity of relays is usually accomplished through timing, the breakers nearest the source of power being the last ones to go out in case of a line fault. However, relays of other types can often be employed to advantage, other types commonly used being the bellows, the thermal and the straight instantaneous. In the examples given in this article relay adjustment for time is necessary for the proper operation of a number of the schemes.

The simplest kind of protection against the accidental grounding of a feeder is shown in Fig. 1. Any ground current flowing results in an unbalance between the three current transformers, the exact ground-current equivalent appearing in the ground relay and causing it to operate. If ground relays are used at a point between the feeder and the source of power, their time setting must be longer than that of the ground relay protecting the feeder so that the latter shall get an opportunity to clear before a large portion of the system is affected.

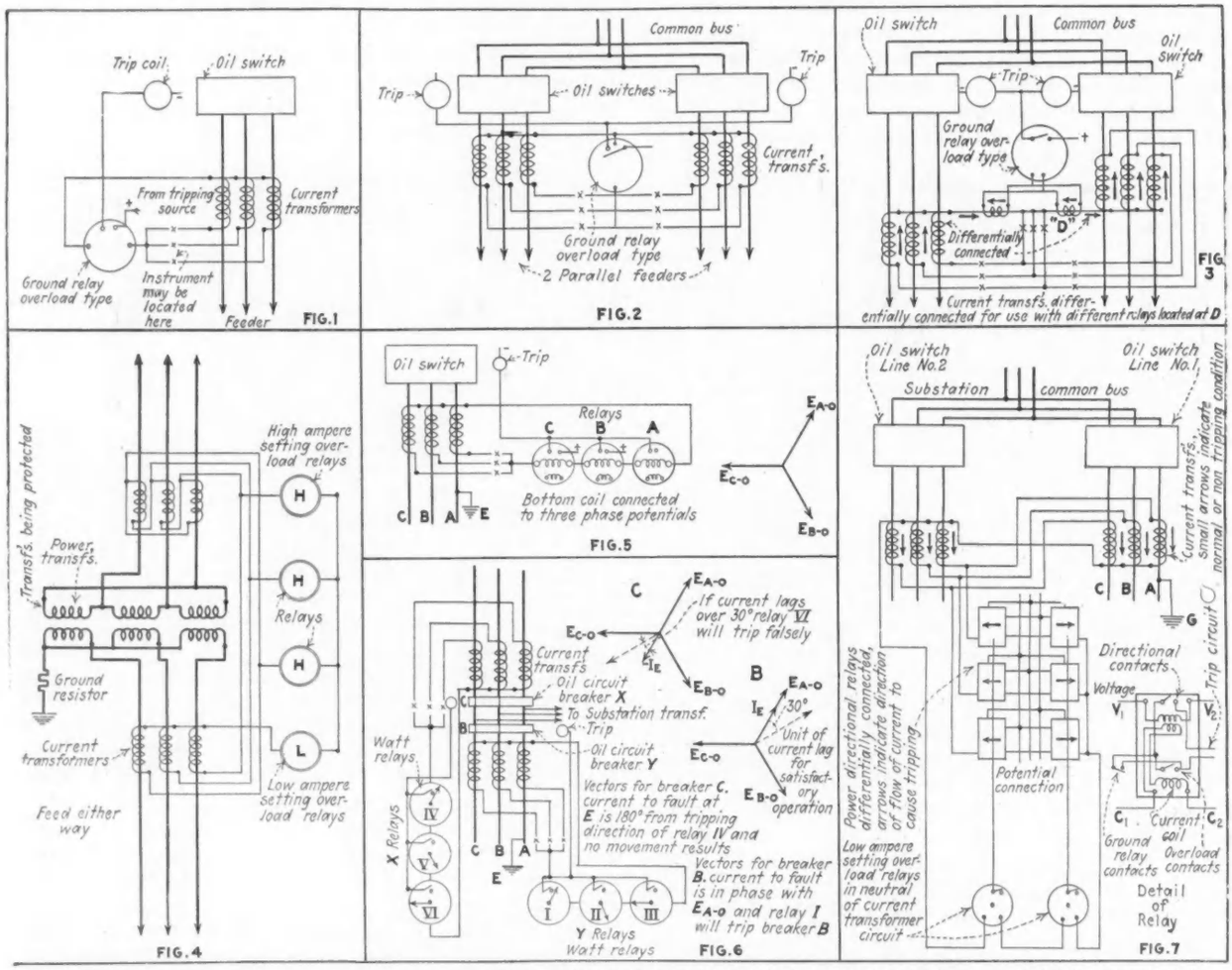
A scheme for tripping the circuit breakers feeding a bus in case of a fault to ground in the bus is shown in Fig. 2. All of the ground current is carried through the ground relay. Operation of the relay trips out all breakers feeding power into the bus. In case the current transformers on the lines are differentially connected as indicated in Fig. 3, it is necessary to install 5/5-amp. current transformers in order to sum up the total ground current, this being used for bus ground protection.

Where the grounding resistor of the neutral of the system has a high ohmic value, the current resulting to ground in case of a fault may be so limited in value that relays designed for overloads or short circuits will not operate. In Fig. 4 a scheme is shown where the ground current only flows through the relay marked *L*, and hence this relay may be of a very low current setting. The advantage of the connections illustrated is that switching surges appear as three-phase currents in the relays marked *H* and do not disturb relay *L*. Similarly, different characteristics of current transformers on the high and the low side of the power transformer will not cause tripping currents in the relay system throughout the range of operation of the power transformer. This is because the currents are balanced and do not flow in the ground relay, while the *H* relays are set high against this very contingency.

In many cases the use of directional relays is preferred to those operating on amount of current only.

Such relays respond both to amount and direction of the ground current. An example of this type of protection is given in Fig. 5, where three relays are employed to trip one switch. The middle coils of the relays are connected in series and carry the ground current. The bottom coils are connected to a three-phase potential source, one phase per relay as illustrated in the vectors. A fault current to ground on wire *A*, for example, would appear in all of the relays simultaneously and in phase. However, only relay *A* would operate, because it is the only one where the voltage and current are in phase. This idea is extended tending to trip the upper breaker. These operations are on the basis of unity power factor of the ground current. In case the ground current should lag more than 30 deg. the wrong relays will operate. At 30 deg. lag the torque in either set of relays is 86.6 per cent. If the ground resistor has a high ohmic value and the lines protected have a low reactance, it is possible that the power factor of the ground current cannot fall below 86.6 per cent in case of accidental ground. On such systems the directional ground relays of Fig. 6 may be used successfully.

For the receiving end of parallel transmission lines

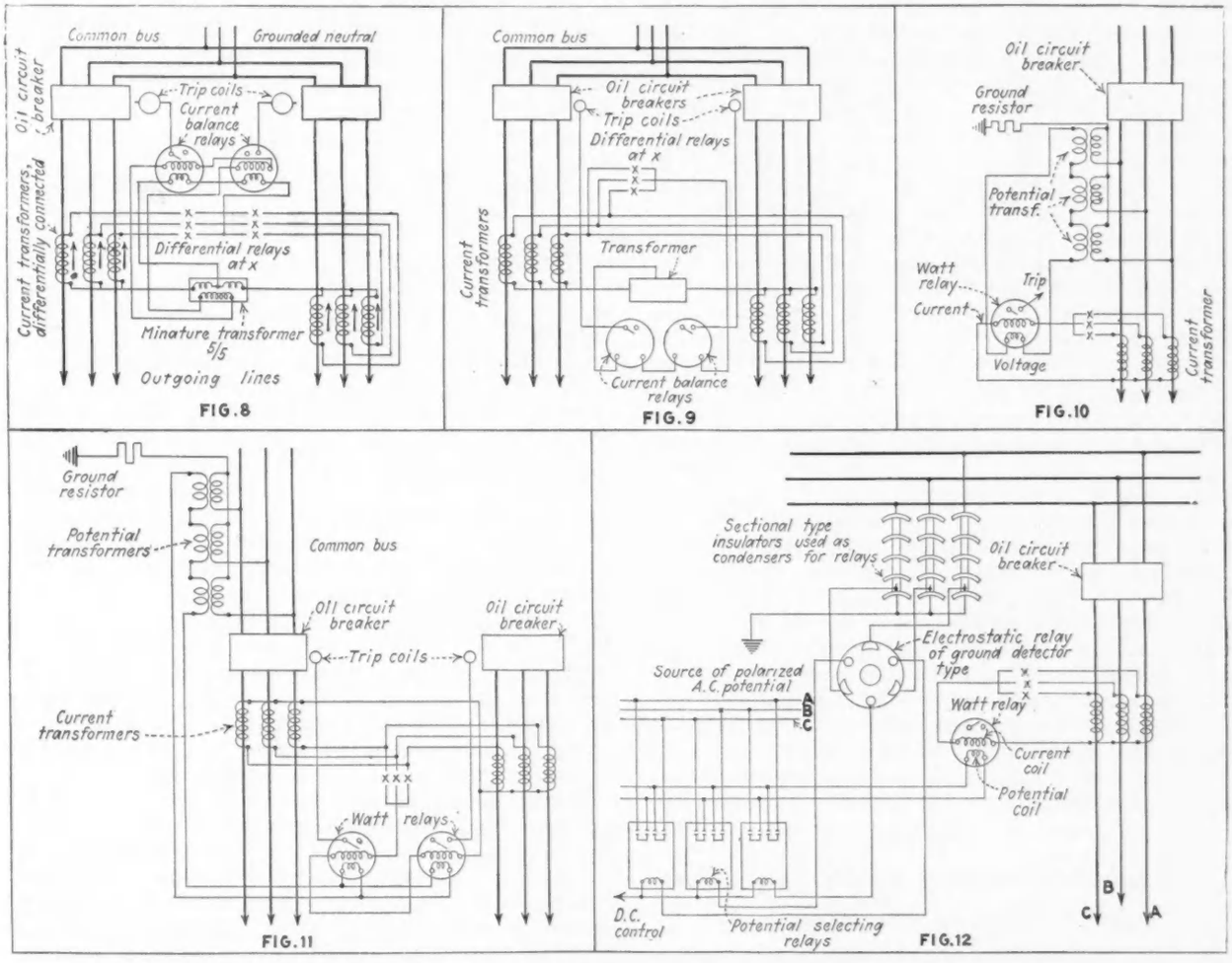



**OVERLOAD RELAYS OFTEN MUST BE SUPPLEMENTED WITH DIRECTIONAL RELAYS TO OBTAIN SELECTIVE GROUND PROTECTION**

Fig. 1—Time-element overload relay for protecting single outgoing feeders. Fig. 2—Overload-type relay for bus ground protection. Fig. 3—Overload-type relay with differential connection of current transformer for bus protection. Fig. 4—With a resistance ground, switching surges do not affect ground relay L. Fig. 5—Three relays are used in series to trip. Fig. 6—Directional relay scheme for substation application. Fig. 7—Receiving ends of transmission lines protected by directional relays.

in Fig. 6, showing both sides of a substation, where a tap for the station feeders is placed between the switches. A fault to ground in wire *A* should only trip the breaker between it and the substation bus. However, ground current may be flowing from the source of power above the substation and, appearing in the *X* relays, will tend to trip two of these with a torque amounting to 50 per cent of the torque developed in relay III. This comes from the fact that the current and voltage are out of phase by 60 deg., the cosine of the angle being 0.5. In relay III the current and voltage are in phase and the torque is 100 per cent. The lower breaker, *Y*, should trip first because of time selectivity, its relay having twice the torque of the relays the ground relays of Fig. 7 can be used satisfactorily. The overload relays are cross-connected and are set to operate upon excess power flowing from the bus. Because of the cross-section of the relays the directional elements corresponding to one line will most likely be closed. The relays receive the difference between the secondary currents of the two lines, and some slight unbalance must always be present due to inequalities in resistance and reactance of the lines. If a ground occurs on the bus, the ground current in each line will be approximately the same and will circulate through the current transformers without passing through any of the relays. Should a ground occur at the point marked *G*, a ground current will be drawn from the

source and will pass through the receiving stations as shown. The direction of the ground current will be "in" on line 2 and "out" on line 1. The directions of flow being reversed, the ground current will appear in double quantity in the relay system, causing the ground relays to operate. When the contacts of the ground relays close, the current setting of the directional relays is removed so that outgoing power will trip its breaker. Ordinarily the only outgoing power is represented by the ground current in line 1 as indicated, but because of inequalities in line characteristics it may be that line 2 carries slightly less current normally than line 1 does. Were such the case, a ground fault at *G* would cause a reversal on phase *A*, but would leave phases *B* and *C* set for operation of line 2. This difficulty may be overcome by having ground relays function to change the overload setting of the directional relays, instead of omitting it altogether. Unfortunately the inherent design of commercial relays renders this object difficult of accomplishment.




NETWORK AND MULTIPLE FEED SYSTEMS REQUIRE SPECIAL TREATMENT TO OBTAIN GROUND PROTECTION

Figs. 8 and 9—Current-balance scheme for use on the sending end of single and parallel transmission lines. Fig. 10—Current-balance directional relays are required to protect the receiving end or intermediate stations on multiple-fed transmission system. Fig. 11—Special-type directional relays are used to secure protection on parallel transmission lines. Fig. 12—An electrostatic method for obtaining proper phase and potential on directional relays. A direct-current trip circuit is used.

## Directional-Balance Relays

Current directional, or current-balance, relays may also be used for ground protection. In Fig. 8 the line relays are connected for single-line operation, while in Fig. 9 they are cross-connected for parallel-line operation. In either case the ground relays respond satisfactorily to outgoing ground current only. They are not suitable for receiving-end operation because when the ground current flows in on one line and out on the other the current-balance relays operate as though the ground current were in or out simultaneously on both lines. In other words, some polarizing force must be present in order to render such ground relays directional. This force is commonly obtained from potential between phases or between phase wires and ground.

To obtain the proper phase of potential to impress on ground relays is no easy matter. The methods so far known require auxiliary equipment, which is expensive and which may add to the complications of the system of relays. But directional ground relays are often worth the price, as they are the only kind which will operate at intermediate stations of a long transmission system fed from more than over one point and which has more than one permanent ground resistor connected to the line at remote points, at one time. In such cases the load current may flow in one direction and the ground current in another. In fact, it is impossible to foresee the direction of the ground current, its amount or its relative phase with respect to the load current. Hence ground directional relays must receive, besides the ground current, a potential approxi-

mately in phase, or 180 deg. out of phase, with the ground current. If the current and voltage are in phase, the relay will operate after its time limit is reached; if the current and voltage are 180 deg. out of phase (approximately), the ground relay contacts will go against the stops in the reverse position from normal tripping direction.

In Fig. 10 the approximate phase of the ground current is obtained from three potential transformers, star-connected on the primary side and delta-connected on the secondary side. The neutral of the potential transformers is grounded through a resistor, and the ground relay is inserted in series in the delta. When a ground occurs on a line wire the effect is to upset the balance of the voltages to neutral in the potential transformers. The potential across the relay, normally zero, now rises to about three times the voltage corresponding to the voltage ratio of the potential transformers, and its phase is that of the grounded line wire to ground. This method of ground relay protection can be used on lines which have no grounded neutral.

The connections for the same relay when used for parallel lines, cross-connected, are shown in Fig. 11. Two separate relays are used instead of one three-contact differential relay because of the greater time selectivity which occurs on account of the greater arc of movement of the swinging contact arm of the relay. There are instances where no live line is available for energizing the potential transformer. With modern multiple transmission-line installations, using duplicate buses, it is difficult to obtain satisfactory potential connections without throw-over switches. In this case the switches would be on the high-potential side, and thus would necessarily be cumbersome and expensive.

An electrostatic means of obtaining proper phase potential for ground relays is shown in Fig. 12. The connections are similar to those of an electrostatic voltmeter. A ground on a phase wire destroys the attraction on that wire in the ground detector and permits the other two phases to pull the central disk over, causing it to close contacts opposite to the grounded phase. The contacts thus closed permit direct current to flow through potential selecting relays which impress the proper potential upon the ground relays.

## French Engineering Society Opposes Legal Control of the Profession

A SPECIAL meeting of the Société des Ingénieurs Civils de France was held recently in Paris to express the views of the society upon a proposed law making it a legal offense for any one to assume the title of professional engineer except on compliance with regulations of the Council of State passed on the advice of properly constituted professional groups. The report of the committee of the society which had considered the project was adopted by a large majority. It disapproved the proposed law, as well as a suggested amendment that membership in the society should be held equivalent to a diploma and confer the right to the title of engineer. The committee came, instead, to the following conclusions, which are condensed from the report in *Le Génié Civil:*

1. That "engineer" or "civil engineer" is not a title, but the simple indication of a profession to which any person having sufficient technical knowledge is able to belong, his particular branch being properly indicated by the word "construction," "mechanician," "electrician," etc., following the word "engineer."

2. That a properly qualified person not a technical-school graduate should not be hampered by law in following his chosen work.

3. That engineers with diplomas are able easily to defend themselves against usurpation of the titles conferred by their colleges.

4. That a restrictive law would tend to prevent practical men from attaining posts to which entitled.

5. That it would be difficult for the society to accord to some of its members a special dignity of which many eminent engineers would be deprived.

6. That if, notwithstanding the foregoing considerations, it should be thought useful to protect titles conferred by colleges, the committee was not opposed to an addition to the penal code covering this matter.

## Pulp and Paper Industry of Canada Highly Electrified

THE application of electricity in the pulp and paper manufacturing industry of Canada is very clearly brought out in the interpretation of a survey recently completed by the *Electrical News*, Toronto. In any industry the relative necessity of obtaining peak and adequate power may be gaged by the amount required per dollar of product. With the possible exception of certain electrochemical and metallurgical processes, the requirements for pulp and paper are among the highest. The importance of cheap power may be judged from the fact that it takes practically 100 hp. to make a ton of paper per day. Average figures in connection with a large Canadian mill show that mechanical pulp requires 73 hp. per ton of daily output, of which 67 hp. is for grinding alone; sulphate pulp requires 8.7 hp. per ton of daily output, and in other large mills as high as 20 hp. to 30 hp. is needed, while the production of newsprint from pulp consumed 12 hp. for the same unit output. Continued operation of mills in this industry, usually twenty-four hours per day, permits a very advantageous use of the necessary power.

The water-power installation for the operation of pulp and paper mills in Canada aggregates 476,503 hp., while the additional hydro-electric energy purchased for this industry is 160,577 hp., giving a total of 637,080 hp. The use of steam as a source of power in this industry is very limited, being in 1920 reported as 62,400 hp. Electric drive is an important consideration. Of the total water-power installation for the various mills, 178,911 hp. is converted into electrical energy before it is used to operate the pulp and paper machinery.

A rapid inspection of the data in the various tables presented shows that the Province of Quebec is slightly ahead of Ontario in the pulp and paper industry. British Columbia ranks next, followed by New Brunswick and Nova Scotia, while this industry has yet to be introduced into the prairie provinces. Quebec has fifty-four mills, requiring a total of 312,867 hp. either installed or purchased. Ontario has forty-one mills, while the installed or purchased power aggregates 242,746 hp. British Columbia has only five mills operated by water power, but they are all of fair size and require a total installation of 48,000 hp. New Brunswick has three mills operated by water power, with a total installation of 14,668 hp., and Nova Scotia reports ten mills operated by water power, with a total of 17,999 hp.

# The Soviet Plan to Electrify Russia

## Twenty Regional Steam Plants and Ten Hydro-Electric Plants Form the Basis of Electrification—These Plants Require American Capital to Bring Them to Fruition

By DR. CHARLES P. STEINMETZ

IN THE early part of 1920 the Council of People's Economy was instructed by the legislative branch of the Russian government, the All-Russian Executive Committee, to work out a plan of electrification. For this purpose a special committee was created, the "State Committee of Electrification of Russia," with Prof. G. Krizizhanovsky as chairman.

The following instructions given by the central executive committee are of interest in showing an understanding of the economic importance of electrification which is usually not found among statesmen:

"It is recognized that electrification is of prime importance in the development of the natural resources. The concentration of the generation of power in large plants located at the sources of energy makes it possible to transmit and distribute in the most efficient way over the whole country by means of a network of electric lines for industrial, transportation and other uses. It will be especially useful in supplying light and cheap power to the farmers for the various needs of everyday life and so bringing to the rural population the superior advantages of urban districts. It will also improve the facilities existing in the country for other home industries besides agriculture."

More than 180 engineers participated in working out the electrification plan, and the report of the committee was issued recently in the form of a book of 655 pages. This report says:

"The purpose of every economic activity is the obtaining of maximum results with the least effort, in other words, the obtaining of maximum efficiency. There are three ways in which the efficiency may be increased: (1) By doing, through increase of effort, more work in a unit of time; (2) by mechanization, that is, by substituting mechanical power for the muscular strength of men and animals; (3) by rationalization of the work, that is, by proper organization and management and following a well-laid-out plan of production. It can be easily shown that electrification works in all three ways."

The report gives a review of the status of the Russian industries, and the electrical industry in particular, up to the war, and a statement of the effect of the war as far as it is pertinent. It says that a total of 3,000,000 hp. in prime movers was installed in Russia in 1916. Of this 1,800,000 hp. to 2,000,000 hp. was used for driving electric machinery. The aggregate capacity of public electric plants amounted to 450,000 hp. to 500,000 hp.; that of private electric plants to 1,350,000 hp. to 1,500,000 hp.

It is interesting to note that Russia had a considerable electrical industry before the war, so that in 1913 more than half the electrical machinery used in Russia was built in that country. These electrical industries were, however, largely owned and operated by foreigners, and in 1920 the output of the electric factories in Russia was very low. Despite this their equipment, including tools, was, it is said, perfectly intact and ready for the resumption of large-scale operations.

Of the importations, 86.6 per cent came from Germany, 6 per cent from England and 1.8 per cent from the United States. This figure does not fairly represent America's participation in the electrical industry of Russia. While little was imported into Russia from America, a considerable amount of American electrical apparatus was built by the large branch factories operated in Russia by America's great electrical corporations. This is shown by the 311,540 kw. in generators and motors and 96,313 kw. in transformers, out of a total value of seven million dollars, manufactured in Russia in 1913.

### Basic Problem of Russian Electrification

The basic problem considered in planning the electrification of Russia was to utilize in a most complete and perfect way the available resources of production and of labor.

In order to work up a rational plan of the country's economic life, the country was subdivided in economic self-contained units—regions—and the plan for electrification of each region was prepared with the assistance of local organizations familiar with the local conditions. Eight such districts are considered, as shown on the accompanying map.

The present transportation crisis in Russia is well known and should be only briefly mentioned here, before taking up for consideration how much electrification can improve it and thus pave the way to wide co-operation of the various economic centers of the country.

Russia possesses several widely used river systems which do not require much capital to make them real factors in the cheap transportation of goods from the place of their production to the centers of consumption. However, some of the most important industrial centers (as, for instance, Moscow) are situated on water divides, just as some of the most important coal and metal mines are situated in mountainous regions remote from large rivers.

These centers quite naturally became surrounded by railroads, but the latter were always laid as independent trunk lines with the purpose to move goods along the shortest route (in mileage), without any regard to the advantage of moving the freight in some other possible way which at times would have been more beneficial to the country at large.

### Southern District Has Coal

The southern district has the high-grade coal mines of Russia, in the Donetz region. Electrification of the trunk lines connecting the Donetz coal mines with the Moscow industrial district will decidedly increase their capacity. This is the reason why the electrification of

these lines is considered as one of the most urgent needs in order to increase the output of coal in the Donetz district.

There are about seventy power plants in the southern district each of 1,000 hp. or over. Their aggregate capacity is over 200,000 kw. The majority of the coal-mine plants and some of the steel-mill stations are in three industrial centers—Hughsovo-Makeevsky, Almazno-Marievsky and Central. Their total capacity is estimated as 87,200 kw., as shown in Table II. When these plants are interconnected the load factor will be improved, which will permit a higher degree of electrification and will increase the output of the mines as compared with pre-war time.

The stations mentioned are situated in the coking-coal districts. From the broader point of view the coking coal should be preserved and the use of anthracite stimulated. It is advisable, therefore, to install an additional temporary anthracite plant, with an ultimate capacity of 100,000 kw., in the district of Shtervoka. This power plant will serve as a nucleus to a larger regional plant erected for supplying power to the anthracite mines and to fill other needs of that district.

The anthracite resources of the Donetz district are so vast that part of the output can be exported. The port of Mariupol will be used as an export base, and the trunk line connecting this port with the mines will be

TABLE I—SOUTHERN RUSSIAN RESOURCES FOR STEEL MAKING

| Map No. | Industrial Centers | Number of Power Plants: Coal Mining | Number of Power Plants: Steel Mills | Total Capacity in 1,000 Kw.: Coal Mining | Total Capacity in 1,000 Kw.: Steel Mills | Load Factor, Per Cent: Coal Mining | Load Factor, Per Cent: Steel Mills |
|---|---|---|---|---|---|---|---|
| 31 | Hughsovo-Makeevsky..... | 10 | 12 | 36 | 15.5 | 34.7 | 35.5 |
| 32 | Almasno-Marievsky..... | 6 | 2 | 14.5 | 6.5 | 30.5 | 20.5 |
| 33 | Central..... | 4 | 1 | 7.2 | 7.5 | 26.4 | 45.8 |
| | Total..... | 20 | 15 | 57.7 | 29.5 | | |

the first to be electrified. The countries bordering on the Mediterranean are in dire need of mineral fuel, and thus there is a good market for the coal.

Care should be taken, however, to increase the efficiency of mining labor. As compared with pre-war times, efficiency is now reduced owing to underfeeding, to the loss of qualified labor and to obsolete equipment or lack of implements. The electrification of the mines will remove the last two causes, and a comprehensive program for supplying food will be introduced.

The general tendency will be to develop the steam plants into very large producers of power, with a range of action up to a radius of 200 km. Simultaneously with the Shtervoka plant, another one will be erected at Lisichansk, with an initial capacity of 80,000 kw. The immediate purpose of this station will be to supply power to the district where the long-flame coals are mined and also to the Bachmut district, rich in salt mines and various mineral resources. The same plant will supply power for the electrified railroads (part of the net of Donetz railroads and the section of the trunk line adjoining Lisichansk). The Shtervoka plant will use anthracite scrap as fuel, whereas the Lisichansk station will work on coals containing much ash and not suited for transportation.

Anticipating the tremendous increase of electric power demand in a district where coking-coal mines are close to high-grade iron ores (Krivoy Rog and Nikopol veins), plans are made for a hydro-electric plant on the River Dnieper, at the city of Alexandrovsk. By concentrating the river fall in one spot a very large amount of power will become available, and at the same time that part of the River Dnieper which is known for its cascades will be made navigable.

The initial capacity of the contemplated hydro-electric plant will be 200,000 kw. The hydraulic part of this installation will have to be built to the full extent at the start, which will require considerable time both for preparing the details of design and for actual erection. The ultimate capacity of the Alexandrovsk hydro-electric plant will reach 820,000 hp.

Due consideration should be given to plant 34, in the Ekaterinslav district, and to the 40,000-kw. plant (No. 4) to be built in Grishino. The Grishino coal district has grown rapidly in late years, and its power plant should soon increase its initial capacity. The eastern anthracite region will be taken care of by a 60,000-kw. plant at Belaia Kalitva (No. 5). The plant (No. 35) now existing at the Grushevka mines will be extended. The power stations in Rostov will be consolidated and enlarged.

### CAUCASIAN DISTRICT WILL RECOVER RAPIDLY

Because of its favorable situation and density of population there is every reason to believe that Kuban province will be the first to regain its normal life and to make further progress. The River Belaya may be utilized and may give, as estimated, 70,000 kw.

A small steam plant (No. 6), rated at 20,000 kw., will be installed in the lower Kuban valley. It will be used in the first years of electrification and will serve as the nucleus of the huge steam hydro-electric system planned for this district.

The water-power plant (No. 7) in the upper Kuban valley, rated at 40,000 kw., will take care of that country, rich in copper, zinc, lead, iron, nickel and chromium and also in coal. Among the other riches of this land the mineral water springs which have made it famous for summer resorts should be mentioned.

The water power plant (No. 8) on River Terek, rated at 40,000 kw., is close to the Republic of Georgia. Power will be supplied to Tiflis, the capital of Georgia, and to surrounding district. On that side of the boundary line zinc, lead, copper and iron ores are found in abundance.

The Vladikavkaz Railroad, which already has considerable traffic, will soon reach a stage where its electrification will become profitable. Energy will be derived from the two water-power plants just mentioned.

An oil-burning plant of 20,000 kw. (No. 9) will be built in the Grozny oil fields. The need of this plant is most urgent, because electric power will mean a greatly expedited rehabilitation of the oil wells. The oil-burning plant at Grozny and the water-power plant on the River Terek may be operated as one unit, thus making better use of the equipment.

The plants at Baku (No. 37) will be enlarged to 80,000 kw. It should be noted that, owing to the condition of the oil fields, an oil shortage must be expected for several years. The available oil should be used rather for making lubricants and similar products than for fuel. The district where fuel oil has been most extensively used is the Volga valley. Another sort of fuel should be substituted for it.

### VOLGA DISTRICT RICH IN TIMBER

The anthracite of the eastern Donetz region will be brought to Tsaritsine on the Volga over an electrified line. On its return trip this railroad will carry timber for the mines. The timber is sent on rafts down the Volga River from northeastern parts of Russia. Thus

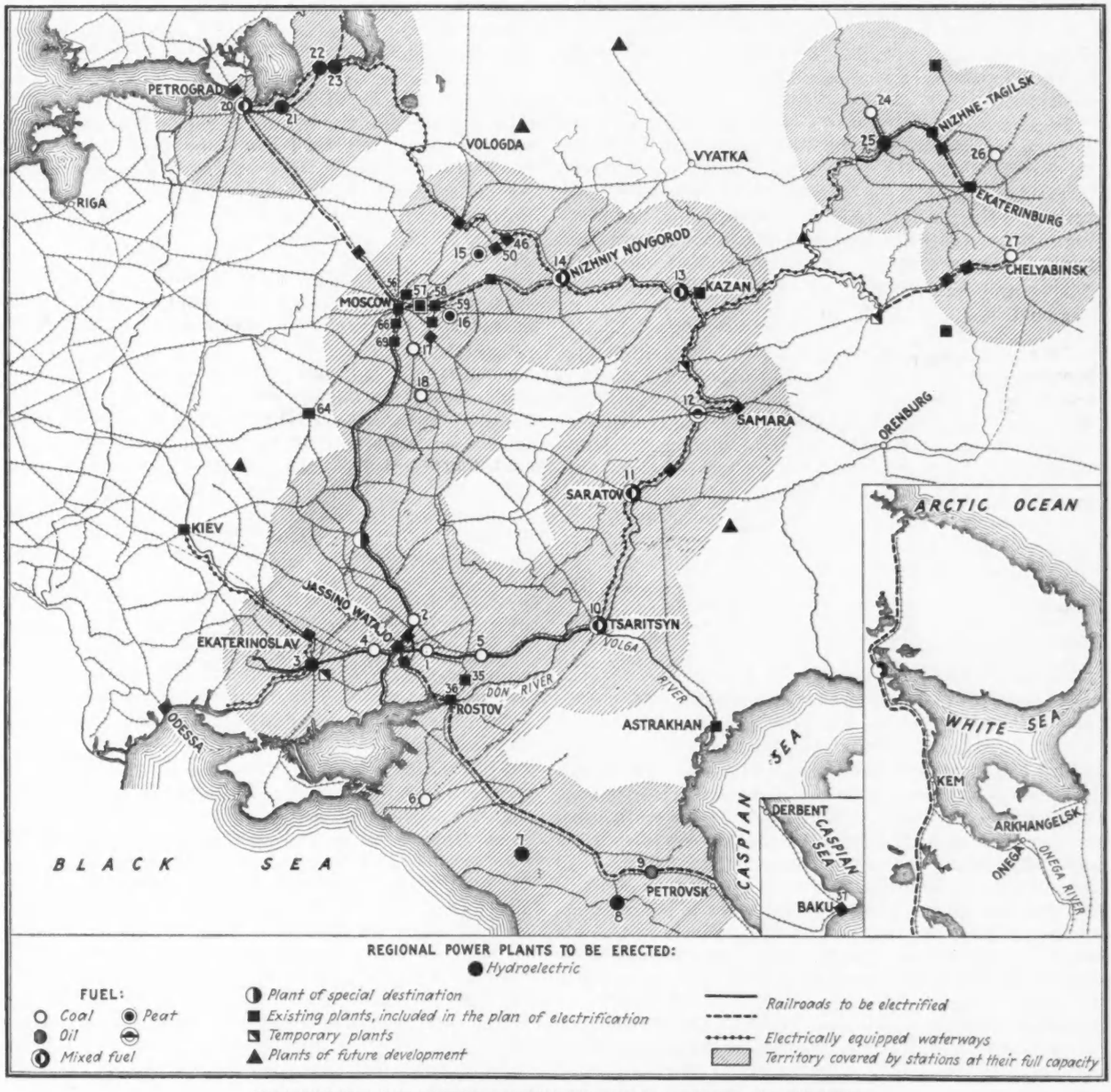
the freight rates will be low and the cost of anthracite in Tsaritsine will be close to its cost at the mines because of the short haulage.

The great quantity of timber scrap from the sawmills at Tsaritsine can be used as fuel for the regional power plant together with the coal carried thither over the electrified railroad. This fact will greatly reduce the cost of power generation, and in turn this cheap power will further stimulate the growth of industries, and even before the war Tsaritsine was a growing industrial center as well as the most important shipping point on the lower Volga. Beyond Tsaritsine water transportation must be changed to rail. It is therefore of prime importance to (a) provide unloading facilities at this point, (b) equip the sawmills adequately in order to get the received timber into the shape most suitable for railroad transportation, and (c) build docks and warehouses to take care of the proper co-ordination of the seasonal character of river transportation with all-year operation of railroads.

The further development of the Volga system as a means of transportation will have a decided effect on the exploitation of natural resources of the northeast, particularly of the Ural region.

It is planned to build a large steel plant at Ufa, on the River Balaya, using water transportation for bringing coke and anthracite from the Donetz district and, in turn, to ship the Ural iron ores down the river to Tsaritsine, where large steel plants are already in existence. The Tsaritsine power plant will be of about 40,000 kw. capacity and will burn timber scrap for fuel. It is also feasible to utilize the blast-furnace gases of the steel plants.

The next points to the north of Tsaritsine where regional power plants will be erected are Saratov (No. 11) and Kashpur (No. 12). Timber scrap will be used




THE PROPOSED SUPERPOWER SYSTEM FOR RUSSIA UTILIZES ALL POSSIBLE FUEL AND WATER POWER RESOURCES

as fuel as will low-grade coal obtained near Kashpur. The plants, which will be about 250 km. apart, will be interconnected and will work as one operating unit.

The main task of these plants will be to supply power for agricultural purposes. Attention should be paid to the salient features of this region which call for its electrification:

1. Periodical droughts, causing crop failures on otherwise fertile lands.

2. The short duration of spring. This necessitates the concentration within a short period of time of the enormous amount of work necessary for the cultivation of fields.

3. At present the peasants split their land in three parts, of which two are cultivated each year, while the third recuperates. In most cases only one kind of crop is planted. It will be necessary to introduce more variety in the plantations and to encourage deeper plowing. Moreover, the animal stock is greatly depleted and mechanical power should be made use of.

This is last year's famine region.

### PEAT FUEL IN CENTRAL DISTRICT

An urgent need for electric power exists in Nijny-Novgorod, which always was a very important industrial center and grew even more so during the war, when many factories were moved there from western Russia.

Vast resources of peat fuel are found in the deltas formed by the Rivers Oka and Volga. The marshes near the city of Balahia alone contain more than 30,000 acres of good peat. These marshes are near the Volga, where a regional power plant could be built. The work of developing peat will be combined with the drainage of marshes and making them available for cultivation.

The most urgent problem of the Moscow district is that of bringing in raw materials, especially fuel. To relieve the critical situation it is planned to electrify the coal region around Moscow by means of power transmission from the Kashira* and Epiphan power plants to Moscow and to electrify the trunk line from Moscow to the Donetz district to provide cheap transportation of coal.

There exists at Bogorodsk, near Moscow, a regional peat-power plant feeding Moscow in conjunction with the Moscow plants (Nos. 57 and 58). The industrial power plants of Bogorodsk district are connected to the same system (No. 59). The Bolshovskia plant (No. 56) acts as a nucleus of another regional station in the district of Mitishti. All the above plants are using peat as fuel, burning wood in emergencies. Only the plants of Moscow are built for oil burning.

To stimulate the peat production a 5,000-kw. plant is built on the Shatursky peat marshes. Eventually it will be developed into a regional plant interconnected with the Bogorodsk system.

The existing plants in the Ivanovo-Voznesnsk and Kineshno-Vichugsk districts (Nos. 46 and 50) will be consolidated. The aggregate capacity is about 20,000 kw. In some of these plants steam is also used for manufacturing processes, so that the power generation is inexpensive.

A few similar plants around Podolsk and Serpuhov (Nos. 66 and 69) will be included in the system of the 60,000-kw. Kashira plant. The Epiphan plant, also of 60,000 kw. capacity, will be in the center of a coal-mining district where iron ore is also found in considerable quantities.

The coal mines around Moscow do not produce coking coals, and these will be brought from Donetz. The return cars will carry the ore to the south, supplementing the output of the Krivoy Rog iron mines. The existing steam plants around Briansk (No. 64) will be consolidated. A 40,000-kw. station will be built at Belgorod (No. 19) to supply power for the adjoining section of the electrified trunk line.

### NORTHERN DISTRICT TO BE FIRST TREATED

In the northern district of Russia the power supply of Petrograd will first be taken care of in order to revive the industrial life of this section and of the port of Petrograd. The largest items of the port's business in former days were the exportation of timber, which in 1913 came to 104,000,000 poods, or 1,872,000 short tons, and the importation of coal, which in the same year totaled 191,000,000 poods, or 3,430,000 short tons. The imported coal was used for the industrial and power plants of Petrograd.

TABLE I—FIRST PART OF RUSSIAN PROGRAM OF ELECTRIFICATION

| | Districts | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Northern | Central Industrial | Southern | Volga | Ural | Caucasus | Siberia and Turkestan | Total |
| Number of steam plants | 1 | 6 | 4 | 4 | 3 | 1 | 1 | 20 |
| Number of hyrdo plants | 3 | ..... | 1 | ..... | 1 | 3 | 2 | 10 |
| Rated capacity of steam plants, kw. | 30,000 | 280,000 | 280,000 | 100,000 | 140,000 | 20,000 | 40,000 | 890,000 |
| Rated capacity of hydro plants, kw. | 130,000 | ..... | 200,000 | ..... | 25,000 | 100,000 | 80,000 | 535,000 |
| Installed capacity of steam plants, kw. | 40,000 | 360,000 | 330,000 | 120,000 | 180,000 | 30,000 | 50,000 | 1,110,000 |
| Installed capacity of hydro plants, kw. | 155,000 | ..... | 230,000 | ..... | 30,000 | 125,000 | 100,000 | 640,000 |

The lumber is brought to Petrograd over the Rivers Svir and Volhov, which abound in cataracts. The building of water-power plants on these rivers will at the same time improve the navigation. Hydro-electric plants on the Svir and Volhov will first be built (Nos. 21, 22, 23).† The Volhov plant (initial capacity 30,000 kw.) will incidentally connect Petrograd with navigable rivers 2,000 km. in length. The development on the Svir will radically improve the capacity of the existing Maricnsky waterway system. The rating of the Svir plant will be 100,000 kw.

The seven plants in Petrograd to be consolidated will have a combined capacity of 112,000 kw. (Altogether there were in that city more than 200 plants, of which forty-four were of 500 kw. or more.) The construction of a regional power plant in the Petrograd country was started before the war (No. 20). It will be completed and the plant capacity brought to 30,000 kw.

The Petrograd steam plants will be interconnected with the water-power plants. The steam plants will use peat and timber scrap as fuel. The total fuel consumption will not be great, because the basic load will be carried by the hydro-electric stations.

The installations on the River Svir will supply power not only to Petrograd but also for the district along the

*The Kashira plant was opened a few weeks ago, supplying power to Moscow over a 110,000-volt transmission line.

†The Volhov plant is now under construction, the electrical and turbine equipment having been ordered in Sweden.

southern part of the Murmansk Railroad. The country traversed by this line is noted for its abundant water systems, which are thus tapped by the railroad, and also for its riches in timber and minerals. Plant 23 on the Svir will furnish power to the canal zone of the Maricnsky system. The latter will be reconditioned to take care of bulk traffic from Volga and Kama to Petrograd.

### ELECTRIFICATION IN URAL DISTRICT

The Ural mountain ridges, separating Europe from Asia and the adjoining country, were quite recently connected with European Russia only by the River Kama and by two narrow-gage railroad lines. The latter were used mainly for the Siberian traffic. The construction of the Volga-Bogolminskaia and of the Kazan-Ekaterinenburg Railroad, with bridges at Simbirsk and at Sviajsk, makes the situation better, but there still is an imperative need of improvement of navigation on the River Kama (up to the city of Perm) and the River Belaia (up to the city of Ufa). At these points the waterways are tapped by the trans-Ural railways, the capacity of which will be raised by electrification.

In the first place the line from Perm to Nijnytagil and the branch to the Lunievskie coal mines should be electrified. The power will be supplied from the Kizel plant, now under construction. This plant, built for coal-mine use, will be converted into a regional plant of 40,000 kw. (No. 24). A 25,000-kw. hydro-electric plant will be built on the river Chusovaya (No. 25).

The plants just mentioned will be interconnected and will together cover a territory containing the most important Ural coal mines and steel plants.

The Ural district has no coking coals, and their place is taken by charcoal, the available supply of which is limited by reforestation restrictions. For this reason the use of charcoal should be restricted to purely metallurgical processes, whereas for other purposes mineral coal should be used as fuel.

A 40,000-kw. plant will be erected at the Egorshinsky anthracite mines. Another 60,000-kw. plant will be built at Cheliabinsk, near the rich brown coal mines (Nos. 26 and 27).

### WEST SIBERIA AND TURKESTAN REQUIRE CAPITAL

The Ural is so rich in high-grade iron ore that it is very essential to connect the district with coal-mine regions and to develop blast-furnace operations to a higher degree.

The connection of the southern Ural region with the Donetz district has been dealt with above. Another plan is to connect the Ural region with the Kuznetsky coal district in western Siberia. The enormous riches of the latter country in coal of the highest grade and its general natural wealth require systematic development.

The northern part of Turkestan, adjoining Siberia, presents similar conditions. A 40,000-kw. hydro-electric station will be built shortly in the Fergan district.

Table II gives an approximate idea of the first part of the electrification of Russia, comprising a total of twenty regional steam plants and ten regional hydraulic plants, with a total capacity of 1,750,000 kw. The estimated cost of this part of the program is $425,000,000 for electrical plants and $145,000,000 for electrification of railways, a total of $570,000,000. Whether it will be possible to carry out this program in the estimated time of ten years will depend on the assistance which can be enlisted from America.

## Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

### Brightness Units and Their Measurements

*To the Editors of the Electrical World:*

Within the last year there has been an increasing interest in the practical application of brightness tests in the selection of lighting units for office and school illumination. In the past lighting units have been selected almost entirely upon their relative merits of efficiency, appearance and ease of maintenance. Recently, however, it has been observed that the brightness of the lighting unit as related to glare has been of first importance. Secondary to these factors are efficiency, appearance, ease of maintenance, distribution and the psychological factor, the appearance of the lighted room.

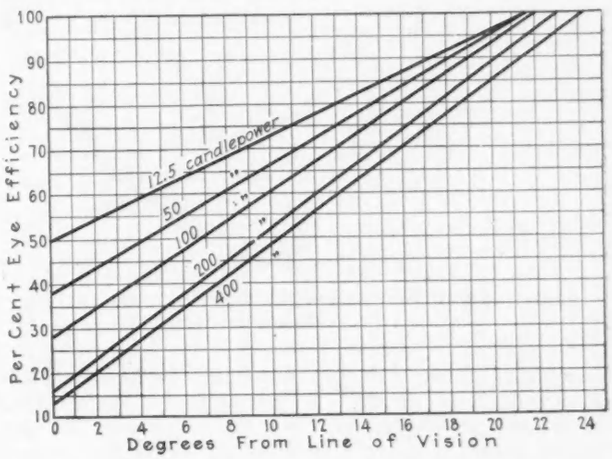



FIG. 1—RELATION BETWEEN GLARE AND VISUAL ANGLE

Brightness as a function of glare applies only in the visual angle, and its effect is greatest at the highest angle. This relation is most admirably shown in the results of tests by Arthur J. Sweet. A graphical representation of the relation between glare and visual angle is shown in Fig. 1.* It is to be noted that the importance of brightness as related to glare applies only to brightness of lighting units between the angles of approximately 66 deg. and 90 deg. from the vertical and that high brightness values at angles near 90 deg. from the vertical have a greater glare effect than brightness at smaller angles. Thus a lighting unit having a brightness of 10,000 millilamberts at an angle of 45 deg. from the vertical would be less dangerous from the glare standpoint than a unit having a brightness of 5,000 millilamberts at 75 deg. from the vertical.

*Brightness Units.*—The most popular unit of brightness and one which is widely used today is the candlepower per square inch. However, the most practical unit, which is advocated by the Illuminating Engineering Society, is the lambert or millilambert.

Brightness† in terms of the luminous intensity *I*

*See report of the committee on nomenclature and standards of the Illuminating Engineering Society.

†See "The Influence of Illumination Conditions Upon Eye Strain," an address delivered before the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers by Arthur J. Sweet, April, 1912.

(candlepower) per unit of projected area of the surface (candlepower brightness) corresponds to the defining equation $b_I = dI/dS \cos \theta$, where $\theta$ is the angle between the normal to the surface and the line of sight. The unit of brightness so defined is candlepower per square inch.

Brightness in terms of the flux, $F$, proceeding from a unit area of the surface, on the assumption that the surface is a perfect diffuser—i.e., it obeys the cosine law of emission or reflection (lumen brightness)—cor-

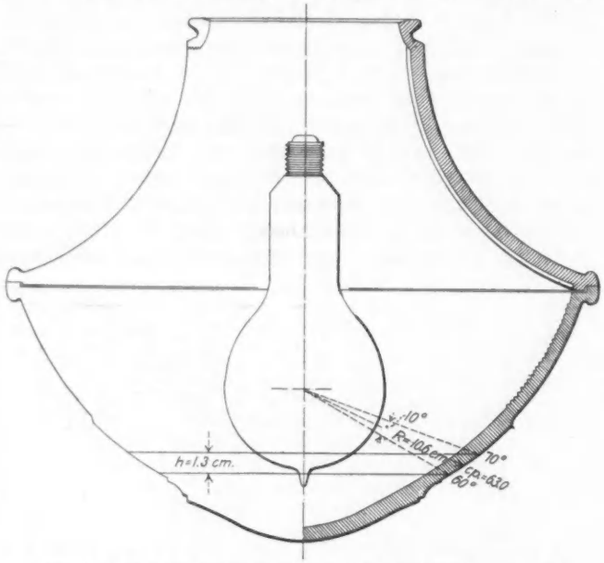



FIG. 2—SECTIONAL DRAWING OF LIGHTING UNIT AIDS IN COMPUTING AVERAGE BRIGHTNESS

responds to the defining equation (perfect diffusion assumed) $b_F = dF/dS$. In this system the lambert, $L$, is the unit of brightness. It is the brightness of a perfectly diffusing surface emitting or reflecting 1 lumen per square centimeter. For most purposes the millilambert, 0.001 lambert, is the preferable practical unit.

When deriving units of flux (lumen) and illumination (foot-candles) we are accustomed to thinking of a point source. We immediately get into trouble, however, with this assumption when thinking of brightness (candlepower per square inch or millilamberts), because a point source would have infinite brightness inasmuch as the expressions $dS \cos \theta$ and $dS$ in the equations become zero. Let us, therefore, consider a uniform spherical source of finite size and use distances so far away from this spherical source that the source is essentially a point.

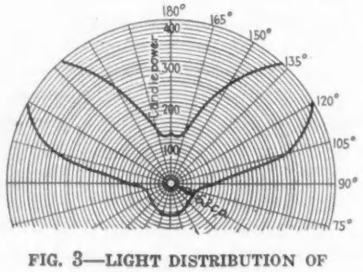



FIG. 3—LIGHT DISTRIBUTION OF GLOBE SHOWN IN FIG. 2

Consider a spherical source of unit radius (1 cm.) emitting unit candlepower uniformly in all directions. The total output from the source will be $4\pi$ lumens. The superficial area of the source is $4\pi$ sq.cm., and, hence the output is equal to 1 lumen per square centimeter and by definition has a brightness of 1 lambert. At any appreciable distance from the source the projected area of the source viewed from this distance is equal to $\pi$, and hence the apparent candlepower per unit of projected area is $1/\pi$ candlepower per square centimeter. Expressed in terms of candlepower per square inch, the brightness would be $1/\pi \times 6.45 = 2.054$ candles per square inch.

In like manner the following equivalents may be obtained:

1 candle per square inch is equivalent to 487 millilamberts.

1 lumen, emitted, per square foot is equivalent to 1.076 millilamberts.

1 lambert = 0.3183 candle per square centimeter and is equivalent to 2.054 candles per square inch.

*Practical Measurement of Brightness.*—It is very desirable when selecting lighting equipment and paints for interior decoration to be able to measure their brightness. This is most readily done by using a brightness illuminometer. The instrument can be aimed at the surface whose brightness is to be measured and readings made on the direct-reading foot-candle scale. Since a foot-candle is equivalent to 1 lumen per square foot and a lambert is equivalent to 1 lumen per square centimeter, the reading on the foot-candle scale is readily converted into millilamberts by multiplying by the conversion factor 1.076.

*Computed Brightness.*—The average brightness in the various 10-deg. zones for a lighting unit can be computed to a close degree of approximation by using the photometric distribution curve and a sectional drawing of the lighting unit. For example, Fig. 2 shows a section of an inclosing globe and Fig. 3 shows a photometric curve of this globe. It is desired to compute the average brightness of the zone contained between the angles of 60 deg. and 70 deg.

The candlepower at the mid-zone position (65 deg.) is taken from the photometric curve as 63.0 cp. The lumens contained in the zone 60 deg.-70 deg. are found by multiplying the mid-zone candlepower by 0.9920, the solid angle content of the zone 60 deg.-70 deg.

Lumens 60 deg.-70 deg. $= 63.0 \times 0.9920 = 62.5$

The area of the surface of the zone 60 deg.-70 deg. is found from the sectional drawing by applying the formula $A = 2\pi rh$, where $r$ is the distance from the light center to the outer surface of the globe at the 65-deg. angle and $h$ is the height of the zone. Both $r$ and $h$ should be measured in antimeters.

$$A = 2\pi\ 10.6 \times 1.3 = 86.5 \text{ sq.cm.}$$

From the definition of the millilambert, the average brightness of the 60-70-deg. zone is then $62.5 \div 86.5 \times 1{,}000 = 723$ millilamberts, or $723 \div 487 = 1.5$ candles per square inch.

DAVIS H. TUCK,
Holophane Glass Company, New York. Electrical Engineer.

## As Told in the Bloomington "Pantagraph"

*To the Editors of the Electrical World:*

The following is quoted from the Bloomington *Pantagraph*:

"During the summer of 1881 I attended some bicycle races at the old fair grounds at Bloomington on July 2, and Bloomington was to celebrate its fiftieth anniversay with a big celebration and fireworks on the Fourth of July of that year.

"The feature that attracted the most attention was four little electric lights on the dome of the court house. The square was roped off, and we stood and gazed at those little bulbs and wondered if they would ever be of any commercial value."

CHARLES MCMURPHY,
Farmer City, Ill. City Engineer.

# Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

## Steel Towers Erected by Unit Method

### Eliminates Straining and Bending of Members When Structures Are Up-ended Complete—Construction Details Outlined

A SYSTEM of building up steel transmission towers in the vertical position, known as the unit method, has been evolved by the Southern Power Company of Charlotte, N. C. This system does away with many of the disadvantages of the usual method where the tower is assembled in the horizontal position and then up-ended. In this latter method the anchors were set in the ground by means of steel or wooden templets. The holes were then back-filled and the anchors were tamped securely into place. The tower was assembled on the ground in a horizontal position, alongside the anchors, and was then up-ended into position by means of a gin pole and suitable rigging.

This method of erecting towers made it necessary to have two teams of horses, a wagon for hauling, a heavy gin pole, five sets of blocks, a suitable timber or "bucking board" against which to up-end the tower, and timbers for temporary struts around the base of the tower. Complete private rights-of-way for transmission lines are so expensive that except for congested districts they are seldom acquired. The towers are therefore usually located on private property, mostly farms, and suitable easements are obtained from the property owners permitting the location of each structure. If there were any crops in the fields when the towers were erected, there was considerable damage done by the assembling of the tower and the teams and rigging used in erection. This involved expense of settling claims and often aroused ill will.

This company, therefore, evolved the unit method, in which many of the difficulties involved in the former method were overcome. The towers were designed and fabricated by the Riter-Conley Company to suit this system of erection. The splices and connections were located and simplified so that they were easy to connect while working up on the tower.

Each construction gang for constructing these towers consisted of a foreman, two erection crews of eight men each, one anchor-setting crew of three men, and sufficient men to dig and back-fill the holes for the anchors, the number depending upon the character of the soil encountered.

One skilled and two unskilled laborers placed the anchors. Templets were furnished, made up mostly of tower members, but it was found that anchors could be placed without the use of templets, and they were therefore seldom used. The surveying party placed one stake at the center location for each tower and one at each side in the direction of the line, as shown in Fig. 2A. By means of two measurements made from these stakes the anchor stubs were put in position. A tape line was suspended as a plumb line from the top corner of the stub angle down to a definite point on the grillage to obtain the proper batter for the stub angle. When the anchor was thus placed in position both for site and for batter, it was held in place by thrusting some light tower members into the earth on each side of the stub angle, as shown in Fig. 2B. A short piece of tower diagonal

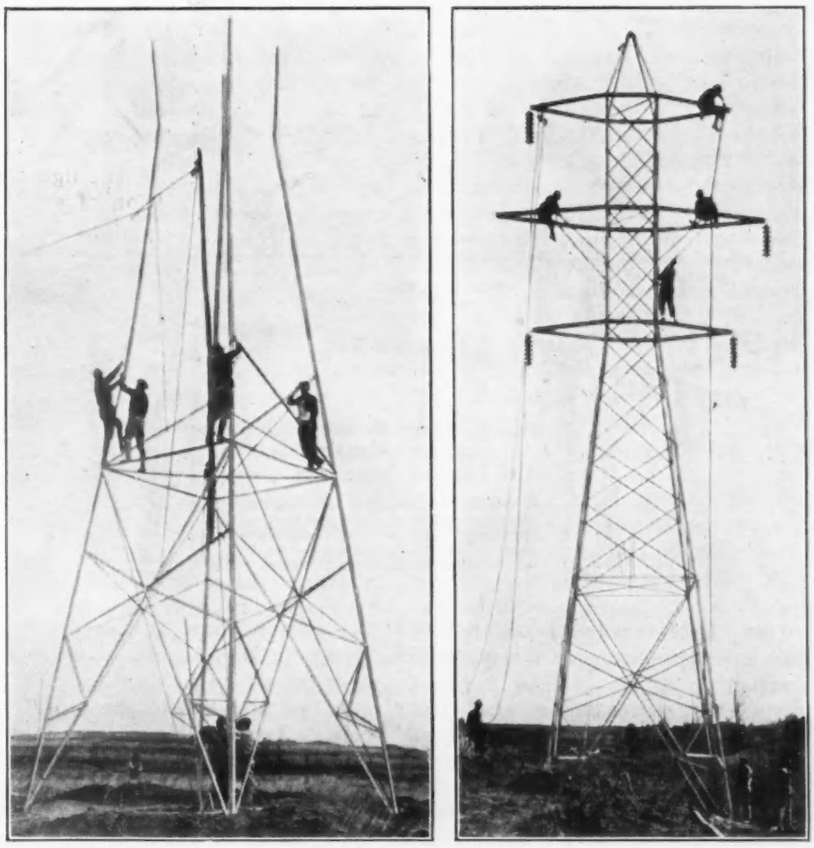


FIG. 1—ERECTING STEEL TRANSMISSION TOWERS BY UNIT METHOD ELIMINATES DAMAGE TO PRIVATE PROPERTY

was bolted to the stub angle to assist in placing the anchors. This increased the length of the stub angle a sufficient height above ground where it could be easily handled, and the extended stub was also used for leveling purposes. One of the main post angles of the tower was used as a leveling board and was laid across the tops of two extended stub angles. A spirit level placed on top of the post angle indicated when the anchors were at the same elevation.

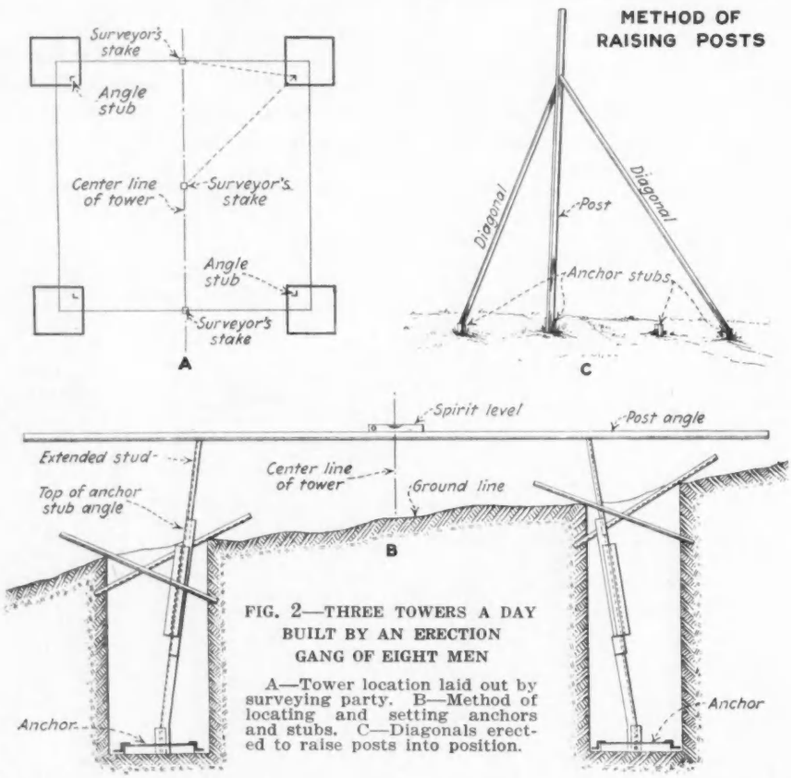



FIG. 2—THREE TOWERS A DAY BUILT BY AN ERECTION GANG OF EIGHT MEN

A—Tower location laid out by surveying party. B—Method of locating and setting anchors and stubs. C—Diagonals erected to raise posts into position.

This operation was repeated until all four anchors were at the same elevation.

Each erection crew had four ground men and four men who could work above ground. The former now proceeded to erect the tower. Two long diagonals were connected to one of the bottom section post angles, and by means of these diagonals the post was raised and held in place, as shown in Fig. 2C. All four posts with their diagonals were similarly erected. The secondary bracing of this bottom section was then placed, followed by the horizontal struts and horizontal diagonal bracing.

The erection of all intermediate diagonals and bracing was facilitated by having holes for ladder bolts in all four post angles of the tower. Temporary ladder bolts were used on all four posts during erection, but when completed, only one post carried a ladder. When the bottom section of the tower was completely erected, the anchors were automatically adjusted to their correct positions, and the holes were then back-filled and tamped by the digging crew. The erection crew was now augmented to eight men, one man worked on each corner of the tower, and four remained on the ground.

A light pole was lashed to one of the corner posts of the tower, as shown in Fig. 1, left. One ground man served as a "dead man" for a guy line attached to the top of the pole. Another served on a "tag line" attached to the piece to be raised. The two remaining ground men attached and hoisted the various members by means of a single block and line connected to the top of the pole. All four second-story posts were raised into position without changing the location of the pole.

The diagonal web members were built into place piece by piece as the men ascended the tower. The top post sections were light enough to be raised into place without the aid of the pole, which was never moved from its initial position.

The four leg angles composing the ground wire mast and the ground wire clamp were bolted to the cap plate on the ground. This section was then raised into position complete. The cross-arms were erected and the same gang of men hung the insulator strings. This is shown on the right of Fig. 1.

When the tower was completely assembled and the insulators hung, the four men who worked up on the tower started at the top and worked down, tightening every bolt. The four ground men proceeded to erect the first-story section of the next tower, as noted above. After some experience one erection crew of eight men has erected as many as three towers per day.

Exceedingly accurate shop work is an absolute requisite for this method of erection, because it would not be advantageous to have the men stop in their work of erection to ream and pin holes while working above the ground.

There are many advantages in this erection plan. There is complete elimination of the straining and bending of members which so often happens when the towers are upended complete. In this unit method of erection every member of the tower is inserted into its correct position and is not subjected to any extra erection strains.

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Riter-Conley Company,
Pittsburgh, Pa.

## Operating Experiences with Boiler-Room Equipment

SEVERAL engineers have expressed the desire for information regarding the operating experience of the boiler-room equipment at the Colfax station of the Duquesne Light Company in addition to that given with the performance figures in the *Electrical World* for Aug. 12, page 329. Some of the more important features that have been giving trouble and have been remedied are mentioned in the following paragraphs:

The brick lining of the ash hoppers is standing up very well after eighteen months of operation, no repairs having as yet been required. In ash handling two laborers are required, and part time of a dinky locomotive and operator is charged against ash removal, as well as part of that of the locomotive-crane operator.

Slagging on the boiler tubes is slight and has never been sufficient

to cause trouble. No serious trouble with piping or valves has been experienced. Evaporators have in general given satisfactory service, although some trouble was experienced due in part to improper design of some features and in part to lack of experience with the particular water being evaporated. The thermal efficiency of the evaporators is practically 100 per cent, and with the modifications now being made it is thought they will give no trouble. No condenser leakage has as yet been detected.

It has been found that dissolved oxygen in the feed water tends to pit the boiler drums, this pitting taking place during banked periods, there being virtually none when the boiler is active. To decrease the quantity of dissolved oxygen all parts of the feed cycle are effectually sealed against air, the feed temperatures being maintained at 205 deg. or higher to drive out the entrained air. Further experiments are being carried on to determine whether a lower feed temperature with higher vacuum in the barometric condenser will improve this condition.

Each boiler is equipped with eighteen soot-blower elements, nine on each side. Trouble was experienced from warping of the elements apparently due to insufficient drainage. The drip system was altered so as to carry this water off more positively, and this sort of trouble was eliminated. Future installations will be modified so that no valves will be required on the individual soot blower leads, thus permitting easy draining of accumulated water and requiring but a single master valve on each side of the boiler. Soot blowers are operated three times a day with the dampers opened wide.

The superheaters are placed over the tube banks between the first and second pass. Considerable trouble has been experienced because of insufficient superheat. The normal superheat should be 180 deg. with boilers operating at 200 per cent of rating, but 145 deg. has seldom been exceeded.

Boilers to be installed this summer will have the superheaters above the sixth row of tubes, and with this arrangement no trouble from deficient superheat is anticipated.

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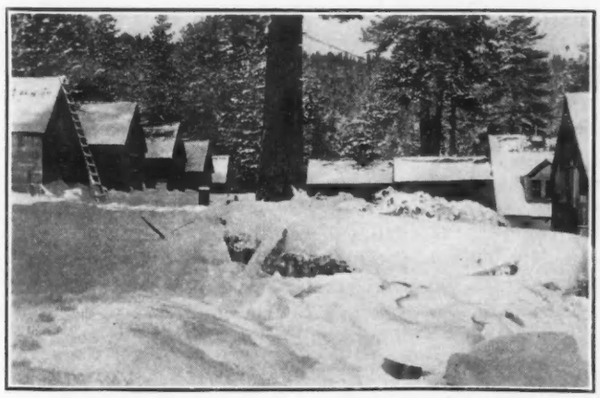
## Experience with Radio Leads to Extended Use

IN THE new developments of the Big Creek hydro-electric project of the Southern California Edison Company the problem of communication during the winter months at altitudes of 4,000 ft. to 10,000 ft. over a large area presented itself and has been met in a satisfactory manner thus far by means of three radio stations. These stations have been so successful that it is planned to extend the service by installing additional stations as new camps are opened.

Because of the snow and sleet storms which are prevalent it was thought that wire communication would not give reliable service unless an exceptionally strong pole line were constructed and the right-of-way cleared of trees for sufficient width to prevent falling timber from striking the line. As the country traversed is all within the National Forest and heavily timbered, this would mean a considerable expense. Therefore radio communication in place of wire communication was decided upon. There are now three combined radio-telegraph and radio-telephone stations in operation. The headquarters station, at Cascada, Cal., at an elevation of 5,000 ft., is in a canyon approximately 2,000 ft. deep with abrupt walls on three sides. The second station is at 7,000 ft. elevation and about 6 miles, in an air line, northeast of Cascada, at the head of Huntington Lake. The third is about 7 miles, in an air line, northeast of the second station, but is only 300 ft. higher. There is a mountain pass 2,300 ft. high between them.

The stations began operations in December, 1920, and during the month of January, 1921, 25,000 words were handled. Business steadily increased to such an extent that during the month of August, 1921, 125,000 words were handled. With a small diminution during the winter months business has continued approximately constant to August, 1922. In addition to regular messages, a news service was instituted which was greatly appreciated by the men in isolated camps. A telegraph operator in the main office sends baseball scores and interesting headlines from the morning paper to Cascada over a wire-telegraph circuit. This news is posted on a bulletin board at Cascada and relayed by radio so that the men at radio stations Nos. 2 and 3 get the news days ahead of the arrival of the dogsleds which carry the papers and mail during the winter.

Owing to the location of the stations, the topography of the country and the fact that little was known regarding communication in mountainous territory, it was necessary to do considerable experimenting before satisfactory results were obtained. Portable radio-telephone sets which had given satisfactory service in the vicinity of Los Angeles were first



LEFT—RADIO STATION NO. 2 IS 7,000 FT. ABOVE SEA LEVEL AND SEPARATED FROM NO. 3 BY A MOUNTAIN PASS.
RIGHT—ROUGH COUNTRY AND SNOWSTORMS HAVE PRACTICALLY PRECLUDED WIRE COMMUNICATION

taken into this territory. Tests were made which showed that to communicate a certain distance it was necessary to use about twenty-five times more power than was needed near Los Angeles. The transmitters now installed use vacuum tubes of the three-electrode type made by the DeForest Company and called "oscillion tubes." One tube is used in a set.

Manual control is used to transfer the antenna from the transmitting to the receiving equipment; that is, a double-throw switch must be placed in one position to talk or telegraph and in the other to hear incoming signals or speech. This, together with the fact that the radio is, of necessity, a four-wire circuit, two for outgoing and two for incoming, precludes its connection to the ordinary two-wire telephone circuit or instrument, except by the use of special equipment, the cost of which does not seem warranted.

### RADIO TELEGRAPH MORE SATISFACTORY THAN TELEPHONE

Use of the radio telephone, therefore, requires that persons wishing to talk shall go to the radio station. This takes up the operator's and party's time to such an extent that the telegraph is found far more satisfactory and is used almost exclusively. The continuous wave is used in preference to the buzzer-modulated wave.

At Cascada the transmitter obtains its filament current from the 110-volt alternating-current lighting supply and plate current from a 1,500-volt direct-current generator belt driven by a 2-hp., three-phase induction motor. As this station receives power over a few hundred feet of 6,600-volt line from Big Creek No. 1 hydro-electric plant, no emergency source of power has been provided. The power plants at radio stations 2 and 3 consist of a 220-volt, three-phase motor, coupled to a 32-volt direct-current generator and belted to a 1,500-volt direct-current generator from the coupling. Under normal operation the 32-volt direct-current generator produces current for the filament of the vacuum tube and the 1,500-volt generator supplies the plate. If the three-phase motor is off, owing to a failure of the 30,000-volt transmission line, the 32-volt generator then operates as a motor from storage batteries, thus driving the 1,500-volt generator. The filaments are also supplied from the batteries in this case.

Each antenna consists of five No. 8 B. & S. gage copper wires spaced 4 ft. apart. At Cascada is an inverted L-type antenna, 140 ft. high at the free end, 90 ft. at the station end and 120 ft. long. At radio station No. 2 is a T-type antenna 140 ft. high and 175 ft. long. At radio station No. 3 is a T-type antenna 90 ft. high and 180 ft. long. The current in each of these antennas is about 2.4 amp. at 540 m., which is the normal operating wave length. These stations have been heard clearly at night in San Francisco, Santa Barbara and Los Angeles.

Each receiving set consists of an audion-detector panel, honeycomb-coil tuner and a two-stage amplifier, but the second step of amplification is seldom used for inter-camp work. The wave length of the receiving tuner is from 180 m. to 25,000 m.

Some very good results on long-distance reception have been obtained. Following are the important stations that are heard consistently, together with the international call letters by which they are known: All stations on the west coast of North America as well as the United States Navy station NPM at Pearl Harbor, Hawaiian Islands, and NPM at Cavite, Philippine Islands; also the Mexican government station XDA in Mexico City. On the East coast all of the long-wave stations as well as NAW in Cuba and NBA in the Canal Zone are heard. The only European stations that the operators have made note of hearing are POZ at Nauen, Germany; LCM in Norway, and LAF, the new Lafayette station near Bordeaux, France.

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## Meter Tests to Be Provided by Illinois Commission

IN AN amendment to the rule covering meter-test requirements the Illinois Commerce Commission proposes to test service meters for public utilities having not more than 250. Fees are to be charged and requirements are made in addition by which the utilities will pay for time and material used for repairs and furnish transportation if the meters to be tested are in rural districts. The scale of fees is as shown in the accompanying table.

Where instrument transformers are used the rated capacity of the meter is considered to be that of the complete metering installation and is determined by taking into consideration the ratio of the instrument transformers.

It is not intended that this rule

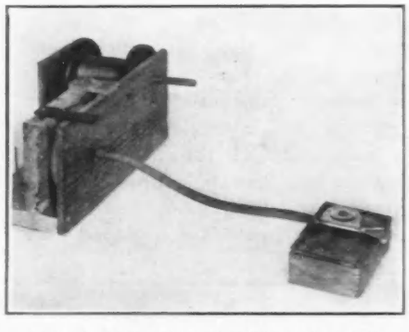
| | |
|---|---|
| (a) For single-phase watt-hour meters operating on circuits of 650 volts or less and having not to exceed 25 amp. rated capacity | $0.60 |
| (b) For each additional 50 amp. or fraction thereof | 0.10 |
| (c) For direct-current watt-hour meters operating on circuits of 650 volts or less and having not to exceed 25 amp. rated capacity | 0.75 |
| (d) For each additional 50 amp. or fraction thereof | 0.15 |
| (e) For single-phase meters operating on circuits of more than 650 volts and for polyphase meters, with or without instrument transformers, having not to exceed 25 kva. rated capacity | 1.25 |
| (f) For each additional 25 kva. of rated capacity | 0.25 |
| (g) For each demand meter | 0.75 |
| (h) A minimum charge of $10 will be made for any single series of such tests in each municipality, which shall be considered to include the rural territory adjacent thereto. | |

shall apply to the testing of meters measuring energy for resale, nor in the case of electric railway or other electric utilities which may sell large amounts of energy through a relatively small number of meters to municipalities, power customers or other public utilities.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

## Wire-Measuring Drum

CONVENIENCE in winding coils for time switches and other apparatus used by the Hartford (Conn.) Electric Light Company is served by the home-made idler drum



TACHOMETER RECORDS FEET OF WIRE WOUND ON COIL

illustrated herewith. Wire is unreeled from the spool shown at the rear of the right-angled standard carrying the spool and drum. The drum is 12 in. in circumference, and its turns are recorded by a revolution counter which thus gives a direct reading of the number of feet of wire wound from the coil at the rear upon a second coil at the left, not shown.

E. Y. RICE,
Chief of Laboratory Staff.
Hartford Electric Light Company,
Hartford, Conn.

# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## More Business Through Better Lighting*

### Improvements in Customers' Lighting Installations Offer Many Opportunities for Increasing Revenue at Small Cost

By G. Bertram Regar
Illuminating Engineer Philadelphia Electric Company

THE possibilities of the lighting business, in its superior usefulness to the customer, as a load builder to the central station and from a commercial aspect to the entire electrical industry are greater than those of any other form of electrical service.

Today the income from lighting for the central stations of the country in general represents 59 per cent of the total revenue. Furthermore, lighting equipment represents 66 per cent of the jobber's sales and 68 per cent of the dealer's sales. Notwithstanding this, very little real concentration on the part of the industry as a whole to reach the saturation point of this class of business has been made.

Lighting has three basic principles:

First—Utilization. Successful business methods demand that the lighting be good, and good lighting is efficient, because the predominating factors have been treated in a scientific way.

Second—The physiological effect. With the recognized advantages, both from the commercial and the industrial standpoints, of a higher intensity of illumination careful consideration must be given the subject of proper direction, diffusion and color of lighting.

Third—Psychological effect. We have been educated to the comforts and refinements of our present-day lives, and the artistic effect of lighting, therefore, plays a prominent part. It may be either pleasing or distasteful.

It must, however, be borne in mind that the relationship of each of these principles to the others varies according to the class of the installation, that is, whether home, store or factory. Some actual instances of the results of improved lighting are interesting as they demonstrate the possibilities of a "drive" for better illumination.

In the bathroom, kitchen, pantry and laundry the utilitarian consideration is predominant, with a mixture of the physiological element. In the bedrooms and study the necessity for a more artistic effect is felt, while in the dining and living rooms the decorative or psychological effect is first. In the majority of our homes there is the constant aim to add to their attractiveness.

#### Residence Lighting

The following interesting case presented itself through a request for better lighting:

The residence was of the usual type, situated in the suburbs. The kitchen contained a pendent fixture with a 60-watt lamp, which was replaced with a semi-indirect fixture containing a 100-watt "gas-filled" lamp and objectionable shadows were eliminated. The sun room contained a four-light cluster with 25-watt lamps. This fixture was replaced by a semi-indirect one containing a 150-watt lamp with a silk shade, harmonizing with the draperies and giving a perfectly diffused light over the room, permitting study and reading in any part of it. A portable floor lamp was added for its decorative value, with the result that its attractiveness created a desire to leave a 25-watt lamp burning in it when the room was not in use. The living room contained a semi-indirect and shower fixture with a wattage of 160. This fixture was replaced by one of a semi-indirect type, with a silk shade, containing a 200-watt lamp. A floor, a table and two mantle portables with amber-tinted lamps were added to the room. These are now in constant use, the center fixture being employed only when general lighting is desired. The total kilowatt-hour consumption for the year 1919 prior to the change was 272. After the change, in 1920, it was 326, and in 1921 it was 337, an increase of approximately 23 per cent.

There are thousands of antiquated fixtures in use today and thousands of instances of an absence of convenience outlets, handicapping the use of electric appliances—all due to lack of knowledge or of proper appreciation of their value.

#### Store Lighting

The value of good illumination is not generally realized, because people feel it unconsciously. They avoid a store that is harshly or inadequately illuminated. In a well-lighted shop they stay longer and shop with more pleasure, owing to the restful feeling of comfort, and they speak well of such a store.

An example of a change in store lighting is interesting as it shows the possibilities of increased revenue. A retail millinery establishment was operating a private plant and using emergency central-station service only for window lighting and store cleaning at night. Cluster and bracket fixtures were in use, and the whole aspect was glaring and unsightly.

The lighting service department of the Philadelphia Electric Company offered to prepare plans for a new installation and the advantages of central-station service were pointed out. The company's proposition was accepted, and the results were so pleasing to the owners that additional work has been done in the nature of showcase lighting and the conversion of steam hydraulic elevator service and a steam carrier system to electric service. The sales arguments of efficient lighting brought to the central-station company an increased income of $2,713 the first year, without additional investment and with little increase in the demand. It also brought a construction job at $5,200 to the contractor.

*From a paper presented at the Pennsylvania Electric Association convention at Bedford Springs, Pa., Sept. 6 to 9.

It has been only in the last three or four years that lighting has in the minds of factory executives been taken out of the janitor service class and placed with automatic machinery and labor-saving devices, where it belongs. Manufacturers are beginning to realize that it is a substantial aid to production.

An investigation conducted in the General Electric Company's Schenectady shops showed that increasing the illumination from 3.8 foot-candles to 11.4 foot-candles in a section devoted to semi-automatic buffing increased the production 8.5 per cent. The increased cost of lighting amounted to 0.4 per cent of the increased value of production. A steel-machine shop in Chicago by increasing the illumination from 3 foot-candles to 11.7 foot-candles showed an increase in production of 10 per cent with an increase of the lighting cost of 1.2 per cent of the pay roll. Here is a large and profitable field for the sale of better illumination.

An analysis of good lighting shows it to be a great creative force for the entire industry. There is, however, a necessity for, first, generally speaking, a higher plane of ethics in the industry; second, the realization by the public and the industry of the benefits of good illumination, thereby creating a demand for it, and, third, ability on the part of those concerned to furnish the means to this end.

### ORGANIZED WORK

Lighting service departments should be organized in every central station, even though they consist of only one man, and their services should be constantly offered to the customers for the purpose of planning new installations and correcting or improving existing ones.

An intensive campaign for better lighting should be inaugurated. It should be done locally by central stations, which should advertise the advantages of good lighting and offer their services in planning lighting. House-wiring and fixture campaigns should be inaugurated, the installations to be made by contractors and perhaps financed by the central stations. In other words, every possible means to create a universal demand for better lighting should be adopted and all concerned should give their active support to that end. Improving a customer's lighting is a real service and offers a fertile field for increased business.

## Line Crews Demonstrate Resuscitation

SIX line crews of the Dallas (Tex.) Power & Light Company showed several thousand persons at the company's annual picnic how they do their work. Among the interesting events for the entertainment of the public were a rescue test and an overhead-line construction test.

DEMONSTRATING RESUSCITATION FROM ELECTRIC SHOCK

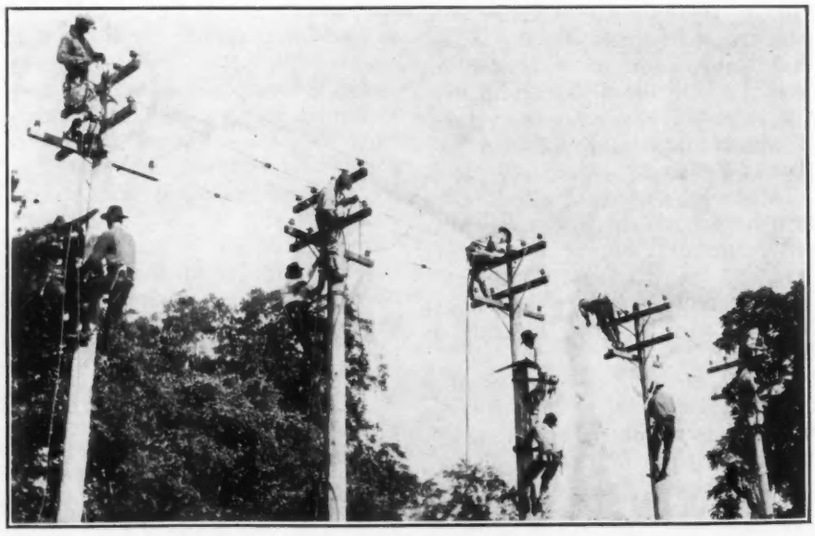
The realism in the rescue contest was such as to give a thrill even to a crowd that knew it was only a demonstration. Six men acted as if they had been shocked into insensibility at the tops of the poles and in each case a crew made a demonstration of rescue and resuscitation for a prize given by the company. A crew made up of D. E. Therrel, Carl Maringo, Jack Baker, Earl Messerole and Charles Mounier won the contest in the record time of thirty-five seconds. The exhibition showed men working on neighboring poles clambering down, lowering the injured man to the ground, removing his belt and beginning resuscitation.

Another event, a test of speed, displayed the same six crews establishing connections, affixing cross-arms and transformer and lighting a house adjacent to the pole. This contest was won by a crew composed of Estes Wood, J. C. Copeland, N. O. Lang, George Winborn and Charles O'Brien. The time was ten minutes and thirteen seconds, thought to be the best for a serviceable permanent connection of this kind.

## Boston Edison's Activities Filmed for the People

CARRYING forward the good-will and courtesy work which has been emphasized on its system so vigorously during the past few years, the Edison Electric Illuminating Company of Boston has just completed a motion-picture film of its service activities which will be shown during the coming fall and winter to many thousands of residents of its territory with the object of making clearer the meaning of the company's immensely varied activities.

The film was prepared under the immediate direction of Leavitt L. Edgar, assistant general superintendent, and J. J. Caddigan, assistant to the general superintendent, and it shows in animated fashion the fundamentals of mining, transporting, storing and burning coal for electrical generation at the company's main plant in South Boston, the handling of turbo-generating and electrical equipment, work of construction and maintenance forces, activities of engineering and sales employees, trouble-hunting methods,

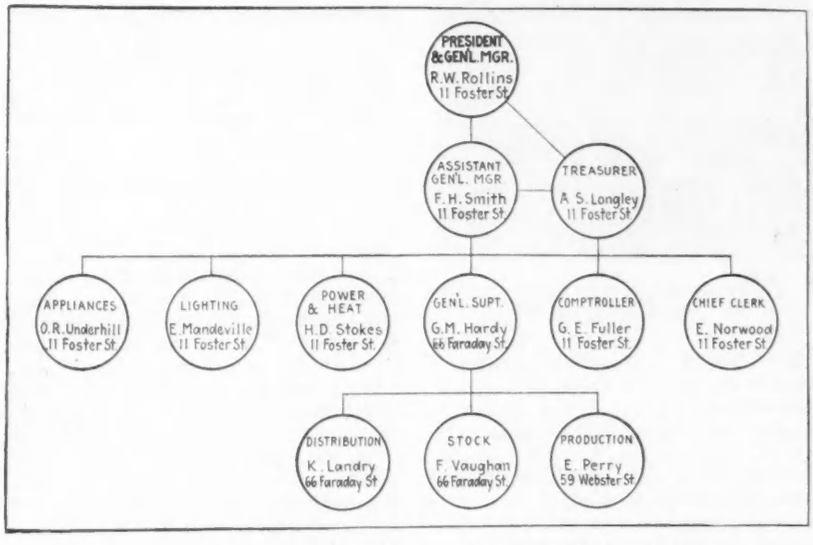


CONTEST IN ESTABLISHING CONNECTION

welfare work and many other doings associated with the supply of energy over the 650 square miles served by the system. All those shown in the film are employees, and the use of electricity in the home is liberally featured. It is believed that this motion picture of the company's activities will arouse even greater interest than the lantern-slide talks upon this subject which were given throughout the territory last winter by employees.

## Organization Diagrams Aid Visitors

TO AID visitors quickly to locate officials of the company, organization diagrams are displayed by the Worcester (Mass.) Electric Light Company at certain office entrances




GENERAL ORGANIZATION DIAGRAM POSTED AT ALL OFFICES

at various points on the system. One shows the location of the principal officials of the company and the other shows in detail the department heads and departmental subdivisions at the local office. The diagrams are particularly valuable in enabling a stranger to determine at a glance whether the person he should see is at that office or elsewhere.

## Interesting Local Bankers in Utility Securities

IN CARRYING out its policy of selling securities to the public the Iowa Railway & Light Company of Cedar Rapids, Iowa, has made a special effort to enlist the interest and support of the bankers in its territory. To this end L. F. Wiegand of the company's investment department has prepared a message addressed particularly to banking officials. This message shows the relation of the banker to the pubic utility company and stresses the importance of co-operation between the banks and the utility for the upbuilding of the community. Among other things it says:

"A commercial bank is a real public utility and its fundamental functions are to accumulate and guard the surplus cash of the community through the receipt of deposits and to furnish necessary funds for its upbuilding by way of commercial loans. The greatest measure of a banker's success is the part he plays in developing the community, the magnitude of his deposits and increasing surpluses.

"Every banker is fully aware of the fact that money is leaving his community daily for speculation in wildcat schemes and that it is to his own credit and the advantage of his bank to encourage the investor to invest at home. Statistics show that wherever utility companies have conducted the sale of their securities to customers savings accounts have increased because the people were taught thrift and America's vital need today is thrift.

"Public utilities in growing communities demand an annual supply of new capital for new extensions, additions and improvements. New capital is demanded constant in ever-increasing amounts, because, first, a public utility is a growing business requiring continually additions to its plants and property; second, these expenditures are for permanent improvement and are all spent in the community and for the benefit of that community.

"What better service can the banker render to his community than to encourage the people of that community to invest their money at home in their own public utility instead of pouring hundreds of millions of dollars each year in 'blue sky' schemes in which great losses of both principal and interest result?

"The strength of a bank depends on the financial soundness of its community, and it seems reasonable that the more local investors can be induced to place their savings in the development of essential industries at home the greater will be the financial stability of the community."

## What Other Companies Are Doing

**Providence, R. I.**—To avoid the interruption in employees' service records which arises in case of a temporary lay-off or other authorized unprotracted absence from the organization, the Narragansett Electric Lighting Company has established a new ruling which retains the seniority rights of any employee who is laid off or granted a leave of absence for a period not to exceed three months.

**Salem, Mass.**—From Jan. 1 to Sept. 15 the Salem Electric Lighting Company connected up 154 old houses previously unwired, compared with 113 for the same period in 1921 and 125 for the corresponding 1920 period. These installations are being made through circularization and letter methods, supplemented by personal solicitation. The householder can obtain wiring on terms as low as $5 down and two years to complete payments.

**Dallas, Tex.**—*Texas Utility News*, a monthly magazine published by the advertising department of the Texas Power & Light Company at Dallas, with Beeman Fisher of that department as editor, recently devoted one entire issue to the electric range. In the magazine of fifty-six pages there were a hundred or more letters from users of electric ranges in cities and towns served by the company, and not one but praised the electric range for its economy of operation, convenience, cleanliness and efficiency. In publishing the letters photographic reproductions were used in most cases and many photographs of kitchens equipped with electric ranges were shown.

# Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Utilization of Waste Heat.*—A group of papers dealing with the application and performance of waste-heat boilers and the utilization of waste heat from blast and open-hearth furnaces and cement kilns.—*Mechanical Engineering*, August, 1922.

*Suggestions for the Use of Small Water Powers.*—R. BESSELMANN.—The article describes two methods of economical use of small water powers. Both methods represent isolated direct-current plants with a storage battery. In one case the storage battery augments the generator during peak-load periods; in the other case an auxiliary (crude-oil) engine, which drives a second generator, is used together with a battery to cover the highest demand. Wattmeter relays attend automatically to the proper division of the existing load between the main generator, the auxiliary dynamo and the battery.—*Elektrische Kraftbetriebe und Bahnen*, Aug. 10, 1922.

*Power Plant of First National Bank of Jersey City.*—This article describes a typical small power plant for a modern office building, which, having been completed only a few months ago, affords a good example of a plant of this type. The equipment includes three 3,085-sq. ft. water-tube boilers, hand-fired, operating at 150 lb. pressure, and three direct-current generators (total capacity 500 kw.) directly connected to uniflow steam engines. Auxiliaries are both steam-driven and motor-driven and are automatically controlled.—*Power*, Aug. 29, 1922.

*Hazards in Hydro-Electric Plants.*—ALEX. E. BAUHAN.—The author describes some of the hydraulic and mechanical hazards present in the operation of a low-head hydro-electric plant and outlines corresponding precautions that the power company can take which should be effective if supplemented by thoughtful conduct on the part of the employee.—*General Electric Review*, September, 1922.

## Generation, Control and Switching

*Commercial Measurement of Power Factor and Volt-Amperes.*—R. C. FRYER.—Several methods for the direct and indirect measurement of power factor and volt-amperes are described. Perhaps the most interesting of these is the Sperti-Blecksmith meter, illustrated in Fig. 1. This meter shows directly kilowatt-hours, kilowatt demand (block interval), volt-ampere demand (block interval), reactive volt-ampere hours, reactive volt-ampere demand (block interval) and average power factor (vectorial) for any given length of time. The accuracy in the measurement of the various factors mentioned is comparable to that of the present standard watt-hour meter. The two right-hand elements shown measure kilowatt-hours while the two left-hand elements measure reactive volt-ampere-

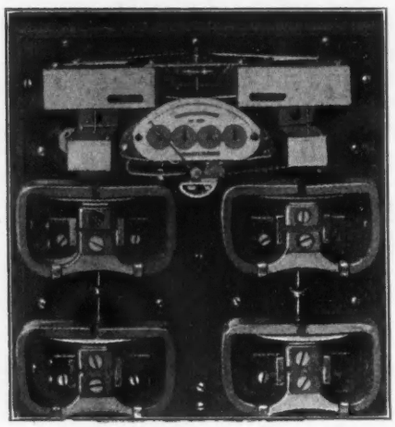


FIG. 1—SPERTI-BLECKSMITH KILOWATT-HOUR AND BLOCK-INTERVAL KVA.-HOUR DEMAND METER

hours. The former are connected to a register train which indicates the total kilowatt-hours and are also connected through reducing gears to the movable arm *A* shown in Fig. 2. The two left-hand elements are likewise connected through gears to arm *B*. This arm is caused to move in a constant direction toward the right, the movement being proportional to the reactive volt-ampere-hours. Arm *A* is likewise caused to move toward the left a distance proportional to the kilowatt-hours. These arms are connected through arms *C* and *D* to an indicating stylus *E*. As arms *A* and *B* move, point *E* travels from its

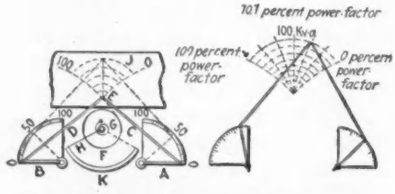



FIG. 2—SCHEMATIC ARRANGEMENT OF INDICATING MECHANISM

zero position a distance proportional to the square root of the sum of the squares of the reactive kilovolt-ampere-hours and the kilowatt-hours respectively. This causes point *E* to travel from its zero position to a point on the kilovolt-ampere-hour scale which is a definite distance from the zero point corresponding to the given kilovolt-ampere value. Point *E* is attached by means of a flexible lead to the circular disk *F*, which is retracted by the light spring *G* and which also carries the indicating pointer *H*. When point *E* moves over the resting plate *J*, the values in kilovolt-ampere-hours may be read directly from the position of the pointer on scale *K*.—*Electric Journal*, July, 1922.

*Design of a Bifilar Non-Reactive Resistance Coil.*—H. NUKIYAMA and Y. SHOJI.—This coil usually gives a condensive reactance at high frequency and the object of the paper is to observe the frequency error at audio-frequency range. The impedance characteristic resembles that of an electric cable, and from this experimental fact a cable theory of a bifilar non-reactive coil is deduced. A practical example of the design of a 100,000-ohm coil, giving a phase angle less than 5 deg. at a frequency of 5,000 cycles, is given.—*Journal of Institute of Electrical Engineers of Japan*, August, 1922.

## Transmission, Substations and Distribution

*Economical Ways of Transmitting Power Underground.*—The importance of keeping a trolley system separate from the power circuit, protection against electric fires and a description of an automatic substation are the features of the report of the committee on underground transmission and distribution presented at the convention of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers at Huntington, W. Va., on Sept. 19. Mine owners have come to realize the importance of keeping the trolley system separate from other power circuits in order that accidents on the haulage road which may tear down the trolley wire shall not interfere with the supply of power for cutting machines, pumps, booster fans and other apparatus. The method of running trolleys and overhanging feeder wires along haulage ways demands careful consideration, and the present practice in this regard is outlined. Figures show that the cost of alternating current is less than that of direct current for operating fans, pumps, coal loaders, etc. A detailed description is given of the self-acting regulatory devices in the automatic mine substation at Van Lear, Ky. Diagrams show connections, and the action of automatic devices is described in detail.—*Coal Age*, Sept. 14 and 21, 1922.

## Units, Measurements and Instruments

*Acceleration Indicator for Hoists.*—G. KEINATH.—This paper describes a transportable apparatus for the accurate measurement and registration of the acceleration of mine hoists and elevators. The instrument consists of a fixed weight attached to one end of a double-arm lever, which is counterbalanced by a calibrated and adjustable spring. To prevent undue oscillating of the lever, a dashpot makes the arrangement dead-beat (aperiodic). To produce an easily readable rectangular

co-ordinate curve upon the registering sheet, the circular motion of the pointer is straightened out by means of a lemniscate lever arrangement. Several curves are reproduced, showing how this instrument can be used to supervise the operation of a mine-hoist regulator and to detect faulty guides or unskilled operation of mine hoists. It is shown how it may also be used to determine the condition of railway tracks and bonds by measuring the shocks of the car.—*Siemens Zeitschrift*, July. 1922.

*Temperature Measurement in Turbo-Generators.*—R. T. PIERCE.—Several means of measuring the temperature of turbo-generators are described, among which are resistance-coil temperature indicators in which the coil is one arm of a Wheatstone bridge, embedded thermocouples with a potentiometer, direct-reading thermocouples and a method that combines the Wheatstone bridge and the direct-reading thermocouple.—*Electric Journal*, August, 1922.

## Illumination

*History of the Tantalum Lamp.*—L. FISCHER.—A very accurate account from personal observations and notes is given of the history of the development of the tantalum lamp, the first successful metallic-filament lamp in use. — *Elektrotechnische Zeitschrift*, Aug. 24, 1922.

*Better Electric Lighting in the Home.*—G. R. LAWALL.—A practical guide for lighting the home, replete with sketches illustrating the use of various types of lighting fixtures to obtain desirable effects in different rooms. The first part of the publication applies to the newly planned home or to a house in which the wiring has had proper consideration and where sufficient outlets properly placed have been provided. The second part considers houses that have been wired for a decade or more in which considerable rewiring would be necessary to provide a modern standard of illumination. Schemes are given for modifying at a very small expense the existing fixtures in such houses to obtain better lighting.—*Bulletin No. 47, Engineering Department, National Lamp Works of General Electric Company.*

## Motors and Control

*Starting Squirrel-Cage Induction Motors.*—R. ELSASSER.—The paper advocates the use of induction motors with a cage armature in connection with a centrifugally operated mechanical clutch between the motor shaft and the driven machine. Such a motor, if started with a star-delta switch, will prevent an excessive current rush at its start and may be used for full-load start of the driven machine. The clutch has the further advantage of acting as a load-limiting device on the motor, as it will open if the motor speed falls below a set limit. A number of oscillograms are reproduced which show the starting characteristics of a 5½-kw. motor under various conditions.—*Siemens Zeitschrift*, July, 1922.

*Power Service on Machine Tools.*—ROBERT HARRIS.—The author describes the motor and control methods adopted by William R. Thropp & Sons Company, Trenton, N. J., in applying motor drive to machine tools. Definite examples show how new operating conditions in a large shop can be met by revamping the power service. — *Industrial Engineer*, Aug. 1922.

## Heat Applications and Material Handling

*Variable-Voltage Installation at the Missouri School of Mines.*—T. M. BAINS.—A description is given of the new equipment for controlling power conditions in electrothermic work. The equipment allows full capacity with voltages from 18.5 to 506, and down to zero at lower capacities.—*Engineering and Mining Journal-Press*, Aug. 5, 1922.

*Resistance Material.*—A. G. KUMMER.—A mixture of quartz and carbon is fired at temperatures between 2,000 and 3,000 deg. C., resulting in a metal carbide which can be formed into rods or tubes. The temperature-resistance coefficient of such a rod is negative up to 600 deg. C., then becomes positive up to 1,000 deg. C. and changes finally again into negative. The material can be used as a heating resistance up to 1,700 deg. C. At the ends, where the rod clamps into clips, the material is metallized to insure a good heat-resisting contract. Owing to its remarkably low expansion coefficient it is possible to pour water on a glowing rod without its cracking, or the rod can be brought to incandescence under water. These rods are being used on a number of air heaters, ranges and commercial ovens.—*Bulletin of the Association Suisse des Electriciens*, July, 1922.

## Electrophysics, Electrochemistry and Batteries

*Relative Value of Cast Grids and Grids of Steel Plate for Use as Resistors in Mine Locomotives.*—According to the report made on this subject at the Huntington convention of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers, Sept. 19, it has been found that cast grids do not warp so much as plate grids, rust less, are more rigid and require fewer tie rods. Summing up the relative merits of cast-iron, cast-alloy and punched-metal grids, the report states that the cast-iron grids will, for stationary apparatus, be cheapest from the standpoint of first cost, maintenance and consistent electrical characteristics. For portable equipment the cast-alloy grids, with a slightly higher first cost, have approximately the same electrical characteristics as cast-iron grids, but the alloy gives an added toughness. Punched-metal grids at a considerably greater first cost give a practically unbreakable resistor element, but in obtaining this quality some of the better electrical characteristics are sacrificed, such as low-temperature coefficient of resistance, thermal capacity and ease in making repairs.—*Coal Age*, Sept. 14, 1922.

## Traction

*Freight Operation on Electric Railways as a Paying Proposition.*—Two papers, one by L. T. Hixson and the other by R. S. Drew, analyzing the various methods by which the cost of hauling passengers and freight on electric railways can be apportioned.—*Electric Railway Journal*, Sept. 9, 1922.

*Limiting Temperatures of Railway Motors.*—G. E. LUKE.—The author discusses the insulation life of railway motors as influenced by temperatures, the relation of motor load to internal temperatures and the method of measuring these temperatures. Insulations for railway motor windings are divided from the temperature standpoint into two classes. The first is composed of specially treated or impregnated cotton, linen, paper and similar materials and is found in light-traction railway motors. This insulation deteriorates in strength with age, even at room temperatures, and its deterioration is greatly accelerated by high temperatures within the motor. The other class is composed of mica, asbestos and other materials capable of resisting high temperatures, which are used chiefly on heavy-traction motors, especially those having strap-wound armature coils.—*Electric Railway Journal*, Aug. 19, 1922.

## Telegraphy, Telephony, Radio and Signals

*New Loud-Speaking Telephone.*—A loud-speaking telephone is described so designed that the speaker has no need to speak into a small mouthpiece or to place a receiver at his ear. The incoming voice is carried 30 ft. from the instrument and at that distance the reply can be given in an ordinary tone.—*Bulletin of the Department of Overseas Trade*, August, 1922.

*Operation of Fire-Alarm Systems.*—J. ELMER HOUSLEY.—The principles of operation of fire-alarm systems for factories are explained, and the author describes how existing installations can be renovated to meet changed conditions. — *Industrial Engineer*, August, 1922.

*Radio Communication.*—W. R. G. BAKER.—The operation of the ordinary wire-line telephone is briefly sketched to make clear, by analogy, the later explanation of the radio telephone. It is shown that the two systems have four primary units in common—some sort of energy conductor between stations, some form of energy capable of being modulated to conform with sound waves, a transmitter and a receiver. Since the type of radio equipment discussed utilizes primarily the vacuum tube, a section of the article is devoted to a description of the principles and characteristics of this device. The rest of the article shows how the transmitter modulates the radio-frequency carrier wave that it broadcasts, how the receiver by rectification of the otherwise inaudible incoming wave reproduces the sound wave and how amplification is accomplished.—*General Electric Review*, September, 1922.

# News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

## Debate Uniform Accounts

**Agreement on Regulation Under Water-Power Act Sought by Utility Men and Federal Officials**

MANY representatives of public utilities and public service commissions are now engaged at Washington in a two weeks' discussion with O. C. Merrill, executive secretary of the Federal Power Commission, in the hope of agreement on regulations to bring about a uniform system of accounting under the water-power act. It seems virtually certain, the Washington correspondent of the *Electrical World* reports, that such an agreement will be reached, despite the difficulties attendant upon any effort to provide a system which will be acceptable to electric utilities in Eastern cities and at the same time meet the requirements of hydro-electric development in the West.

One of the difficult problems with which the conference is dealing is that of the classification of fixed capital, particularly as it pertains to land and structures. There is strong sentiment from the West in favor of classifying fixed capital according to its functions rather than to its characteristics. This classification has a direct bearing on the manner of handling operating expenses.

The inclusion in the water-power act of the 1914 classification of the Interstate Commerce Commission for the regulation of fixed-capital accounts was criticised by H. M. Edwards, representing the National Electric Light Association, who favored the system of the National Association of Railway and Utilities Commissioners. Mr. Merrill explained that this classification was put in the act in order to provide a basis for recapture of properties. Nothing would be more unfortunate, he said, than to allow differences between the jurisdictions of the state and federal bodies.

## Conrad E. Spens Is Made Coal Distributor

President Harding has, on the recommendation of Secretary Hoover, appointed Conrad E. Spens, vice-president of the Chicago, Burlington & Quincy Railroad Company, to be the Federal Fuel Distributor under the act passed just before the adjournment of Congress. One of the first acts of the new distributor was to telegraph the state governors to emphasize the fact that the principal control over price must be exercised by the state authorities and that federal control can be applied only to coal which moves between states.

At a conference of leading bituminous coal operators held in New York it was resolved to urge upon the Fuel Distributor and the railroad executives the imperative necessity of speeding up transportation. An exhaustive survey of the situation was said to show that in many of the soft-coal-producing fields the supply of cars is sufficient to keep the mines going only two or three days a week, while in some fields there has been an even smaller supply. The Association of Railway Executives, however, announce a new high mark for the period since April 1 in the number of cars loaded with coal during the week ended Sept. 23. The total for the week was 212,110 cars, an excess over the preceding week of 16,968 cars. On the basis of this loading coal production during that week approximated 11,500,000 tons, of which about 9,750,000 tons was bituminous.

## Northern Wisconsin Utilities Are Merged

The merger of seven northern Wisconsin utility companies into the Wisconsin Public Service Corporation is announced by Clement C. Smith of Milwaukee, president of the Wisconsin Securities Company, which will hold a controlling interest in the new company. The Wisconsin Public Service Corporation will have a capital stock of $5,000,000, half common and half preferred, and will take over the operation of the Wisconsin Public Service Company, supplying Green Bay and its suburbs with electric, gas and transportation services; the Sheboygan Gas Light Company, the Menominee & Marinette Light & Traction Company, the Calumet Service Company, operating at Chilton and Brillion; the Manitowoc & Northern Traction Company, operating an interurban line between Manitowoc and Two Rivers; the Peninsular Service Company, furnishing electric service to Kewaunee, Algoma and Sturgeon Bay, and the Oshkosh Gas Light Company.

The new company will operate in Winnebago, Manitowoc, Oconto, Brown, Kewaunee, Outagamie, Door and Marinette Counties and will control two large hydro-electric plants at High Falls on the Peshtigo River and Grand Rapids on the Menominee River. An additional hydro-electric plant is now under construction at Johnson's Falls on the Peshtigo River, and a fourth water power will soon be developed at Seymour Rapids, also on the Peshtigo.

## Indiana Utilities Have Faith

**Confidence in the Industry's Future Is Voiced at Annual Meeting of State Association**

INDIANA utilities have not yet found it necessary to ask for increases in rates as a result of the coal and railway strikes, President E. M. Walker of the Indiana Electric Light Association asserted in his annual address at the convention held at French Lick Springs on Wednesday of this week in conjunction with the convention of the Great Lakes Geographic Division of the National Electric Light Association, which continued for the rest of the week. President Walker said that this avoidance of requests for increased rates was a measure of the faith of the men in the business as to its future.

The report of the meter committee showed an increase in the attendance at the meter school at Purdue University this year of 25 per cent over that of last year and a demand on the part of those in attendance for a greater discussion of the practical phases of meter operation and maintenance. A course of from five days to a week, in April, was favored.

D. B. Shourds discussed the by-product electric station, showing the possibilities of the production of gas for fuel, the sale of the by-products and the use of the coke as a commercial fuel. He said that coal from Indiana, Illinois and Kentucky mines could not be used to produce a good grade of coke by the ordinary high-temperature processes, but could be utilized by the low-temperature process to produce coke of a grade comparable to that now produced from the higher grades of bituminous coals at high temperatures.

Asserting that in dealing with the public the utilities are touching the most sensitive nerve of the individual, his pocketbook, Charles A. Bookwalter of Indianapolis likened the methods employed by some utilities in bringing their problems to the public's notice to the actions of a driver who speeds his motor-car engine to its highest rate and then abruptly throws in the clutch. He advocated a careful, consistent and frank setting forth of conditions for the information of the public. The time to do this, he asserted, is before rate issues are raised and passions inflamed.

The officers of the association for the coming year are: President, Harry Reid, Indianapolis; vice-president, Frank Haas; secretary and treasurer, Thomas Donohue, Lafayette.

# Record Units for Brooklyn Edison Company

### Company Begins Work on 400,000-Kw. Steam Station with Largest Single-Cylinder Turbines Ever Built—Cost Will Be About $80 a Kilowatt

THE Brooklyn Edison Company has begun the construction of a 400,000-kw. steam-turbine station, the initial installation in which will call for an expenditure of $8,000,000. Orders have already been placed for two 62,500-kva. turbo-generator sets, eight 1,695-hp. boilers and as many stokers. A plot of two blocks on Hudson Avenue adjoining the Brooklyn Navy Yard and facing the East River is being made ready for the power-house structure, the completion of the first section of which is scheduled for November, 1923.

The steam turbines will be the largest single-cylinder machines thus far built. One will be built by the Westinghouse Electric & Manufacturing Company and the other by the General Electric Company. Each will be wound for 13,800-volt, three-phase, 60-cycle current. Notwithstanding the size of the turbines, it is expected that by the time the final installation is made advances in the art of steam-turbine design may call for the substitution of still larger units. Each turbo-generator set will cover a space 95 ft. long. Orders for the switching equipment have not yet been placed.

Babcock & Wilcox water-tube boilers have been ordered, as have six Westinghouse and two Combustion Engineering stokers. The condensing equipment will be supplied by the Westinghouse Electric & Manufacturing Company.

M. S. Sloan, president of the Brooklyn Edison Company, in commenting on the growth of the Brooklyn system said that load will be available for the new Hudson Avenue station as soon as it is completed. Additions have been made to the Gold Street and Bay Ridge stations of the company, but the demands for service are such that additional energy will have to be procured elsewhere while the Hudson Avenue station is being built. Accordingly heavier interconnections have been completed between the systems of the Brooklyn Edison Company and the New York Edison Company, by means of which large blocks of power can be obtained from the new Hell Gate station of the United Electric Light & Power Company.

The Hudson Avenue station of the Brooklyn Edison Company is being designed by the company's own engineers, with Thomas Murray as consultant. It will cost complete approximately $80 a kilowatt.

## German Trust Organized

A new German trust rivaling the Stinnes Rhein-Elbe-Siemens-Schuckert-Union concern has just been organized with Otto Wolff as the head. The capitalization of the new trust is 684,000,000 marks, and besides coal, iron and shipping groups it contains electrical concerns. Among these is the Dessauer Gas Corporation which controls thirteen gas and electric properties. It also controls the Theydt Electro-Technical Manufacturing Company, which in turn is allied with the Sachsenwerke electrical system of Saxony.

## Pit River No. 1 Is Ready

### New Plant of the Pacific Gas & Electric Company to Be Put in Service Today

CALIFORNIA electrical men are to celebrate today the putting into service of the Pacific Gas & Electric Company's Pit River plant No. 1, east of Mount Shasta, in the northern part of the state, and two hundred representative engineers and business men have made the three-day 500-mile journey into the mountainous country where the plant has been built in order to be present, as guests of the company, at its inauguration.

The completion of Pit River plant No. 1 marks a new record of achievement in electric generation on the Pacific Coast. Not only does it surpass with its 92,000 hp. in total installed equipment the present record west of the Rockies, but it is connected with a line 202 miles in length that is designed for 220,000-volt long-distance transmission of hydro-electric energy. The new installation marks also the appearance of probably the largest 60-cycle hydro-electric generators thus far designed, generators of 35,000 kva. rating. It can boast besides of single-phase, 220,000-volt transformers, equaling in capacity those of the Southern California Edison Company.

Nearly all the large manufacturers of hydro-electric machinery and line material have contributed to the equipment of this plant, an illustration of which, with more details, appears on page 702.

GROUND BEING CLEARED NEAR NAVY YARD FOR 400,000-KW. STATION OF BROOKLYN EDISON COMPANY

## Bay State Commission Bars Tidal-Power Securities

A decision forbidding the sale of securities by the Universal Tide Power Company, the Damiano Tide Water Power Company and the Paesano Hydraulic Power Company has been handed down by the Massachusetts Department of Public Utilities, following an inquiry lasting several months into the financial and engineering situation involved in these concerns' efforts to raise capital at Boston and elsewhere. The commission heard the parties at length, called upon Prof. H. K. Barrows of the Massachusetts Institute of Technology for an expert study of the claims presented, and came to the conclusion that the equipment at present available is purely experimental and that the claims set forth by the promoters, while they may not have been intentionally dishonest, appear to be misrepresentations due at any rate to gross negligence and not made in good faith in regard to future prospects.

The commission feels that the sale of these securities is fraudulent or would result in fraud, and therefore denies their entrance into the Massachusetts market under the sale of securities law. John A. Knowlton, Domenico Damiano and Vincenzo Paesano, all of Boston, are presidents of the above companies in the order named.

## Technical Section Men Confer

Distinct evidence of progress in bringing the members of the National Electric Light Association closer together in technical matters was visible at the group meeting of the Technical Section held at Milwaukee last week. Nearly two hundred men, representing every section of the country, were present. The meetings of the eight committees were held from Monday to Thursday inclusive, and, except for inspection trips to the Lakeside powdered-fuel plant of the Milwaukee Electric Railway & Light Company and to automatic substations, the four days and part of the evenings were spent in intensive work.

On Tuesday night most of those in attendance were present at a meeting at which Chairman R. F. Schuchardt outlined the purpose of the section. This, he said, was to develop its members and bring the largest possible number of technical men among the member companies into close touch with each other and the problems of the industry, which may begin as local problems but rapidly grow into national ones. The desired result, Mr. Schuchardt indicated, cannot be attained so long as the active work is confined to national committees, because at the best only a few men can be included in such activities. He outlined the geographic organization and pointed out that through it and the state committees all problems which are national in their scope can be quickly brought to the attention of the national committees. Through the combined efforts of the state, divisional and national committees these problems can be adequately handled, and the information developed can be promptly and effectively passed back through the interlocking memberships of the various committees. The speaker dwelt on the need of increasing the membership of the geographic technical divisions by bringing in every technical and operating man who can be interested.

## Reading and Harrisburg Utilities in Conflict

The action of the Metropolitan Edison Company of Reading, Pa., in seeking to have the Pennsylvania Public Service Commission approve the acquisition by it of control of the York Haven Water & Power Company and the York Haven Transmission Company has met with opposition from the Harrisburg Light & Power Company, the Borough of Middletown and certain York manufacturing companies.

Lucian H. Tyng, vice-president of the Metropolitan company, denies that it seeks control of the York Haven plant so that it can raise the rates for hydroelectric energy. He says his company plans to increase the capacity of the plant from 15,000 kw. to 25,000 kw. and that an expenditure of $1,000,000 will provide for developing the plant to its highest degree.

The solicitor of Middletown Borough, where there is a municipal plant supplied from York Haven, threatens to carry the fight against the amalgamation to the Supreme Court of the state.

## New Alabama Power Line Will Cost $1,000,000

The 110,000-volt, 90-mile transmission line to be erected by the Alabama Power Company from Mitchell Dam to Opelika and Lanett, the construction of which it is officially announced will begin at once, will, it is understood, cost approximately $1,000,000. In addition, a 44,000-volt line will be built from Lafayette to Opelika, connecting there with the existing high-tension lines and giving Opelika a second source of electric power. The new line to Lanett will give increased service to seven other towns and probably lead to the establishment of new large industrial plants. Lanett itself has more than ten large cotton mills in operation.

## Radio and Wire-Line Service Linked Together

Announcement was made last week by Edward J. Nally, president of the Radio Corporation of America, that an agreement had been signed between his company and the Postal Telegraph-Cable Company whereby every office of the Postal company in the United States becomes an agency of the Radio Corporation for the acceptance of radiograms for transmission across the Atlantic Ocean and for the delivery of radiograms received from overseas for points in the United States.

## Utility Referendum in Indiana

A referendum to ascertain the sentiment of the business men of Indiana regarding regulation of public utilities is under way among members of the Indiana Bankers' Association, the Indiana Utility Association and one other organization. Approximately four thousand business and industrial leaders in the state will be asked to express their opinion before Oct. 18. In view of recent attacks made on the Indiana Public Service Commission and the threatened attempt to abolish it at the next session of the Legislature the referendum is of particular significance at this time. The questionnaire sent out asks four questions—first, whether utilities should be regulated at all; second, whether utilities extending beyond municipal limits should be regulated by state commissions; third, whether in the case of companies operating in one jurisdiction the state or the city should control; fourth, whether a state commission should be made strictly non-political.

## Champions of Ford Project Keep Up Fight

Advocates of acceptance of the Henry Ford offer for the Muscle Shoals project caucused before Congress adjourned and laid tentative plans to renew their effort when the two houses reconvene.

Leader Mondell is quoted as having assured the Ford advocates that personally he saw no objection to having the Ford offer brought on the floor of the House early in the next session.

In the last week of the recent session of Congress the Ford advocates abandoned their tactics of obstructing other legislation in an effort to have the Muscle Shoals bills called up because it was realized that nothing could be accomplished in the short time left.

Hearings also will be asked immediately by Representative Hull on his resolution to refer the whole question of disposition of the Muscle Shoals properties to the Secretary of War with power to act.

## Federal Power Board Seeks to Dismiss New York's Suit

A motion for the dismissal of the petition filed by the State of New York in the United States Supreme Court seeking to bring suit for an injunction against the Federal Power Commission to restrain the latter from issuing preliminary permits and licenses within that state has been filed by Solicitor-General James M. Beck. It is expected that the federal government's motion will be heard by the Supreme Court during the first month of its fall session, and that if dismissal be denied, Attorney-General Charles D. Newton of New York State will apply for an advanced hearing of the petition. Without an advanced hearing the case would not be reached for nearly two years.

# Illuminating Engineers Meet at Swampscott

## Residence and School Lighting, Luminaire Design and Cost of Daylight Among the Topics—Attractive Displays on the Shore and in the Hotel Grounds

THE annual convention of the Illuminating Engineering Society, held this week at Swampscott, Mass., was most successful both from the viewpoint of attendance and with regard to the information that it has made available to the society's members. More than 300 members and guests were registered on Thursday night, the fourth day of the convention. The program was particularly attractive, not only because of the subjects included, but also because of the way in which they were grouped. Excellent entertainment was provided, and special lighting effects were a feature of the convention. Of the papers and reports submitted, those on residence and school lighting, a code of luminaire design and cost of daylight were especially interesting.

### ADDRESSES AND REPORTS

Elihu Thomson, who presented the address of welcome, recalled early methods of illumination and traced development down to the present time, saying that tungsten filament cannot be considered the last word in lamp development.

The ideals and characteristics of the society were emphasized by George S. Crampton, who in his presidential address said that they deserve the unstinted support of all members. The report of the general secretary, C. L. Law, followed.

F. E. Cady, in his progress report, which has almost come to be an institution, referred particularly to the increasing use of neon lamps, colored-light traffic signals, higher-power lamps, attention to street lighting, higher sign intensities and unique church lighting.

Clayton H. Sharp, in his report on nomenclature and standards, pointed out that provision has been made by the American Engineering Standards Committee for a sectional committee to take up current revision. In discussion of these standards it was particularly emphasized by M. Luckiesh and Louis Bell that light should be defined on a physical-sensation basis.

Popular lectures and suggestion of subjects for research have been the chief activities of the committee on education, said Prof. F. C. Caldwell, who pointed out the individual duty of members in this work.

Clayton H. Sharp, the chairman of the committee on motor-vehicle lighting, declared that the principal change in rules has been the increase of headlamp intensities. Color traffic signals have also received much attention. Tail-lamp specifications will be considered in the near future.

Two excellent papers on the status of residence lighting and the field for development were presented by M. Luckiesh and N. D. Macdonald. In commenting on these reports E. D. Tillson of Chicago urged strong support of portable lamps as the best method of improving residence lighting. R. S. Hale pointed out that the reason for the low number of convenience outlets is the narrow interpretation put on the National Electrical Code. Education of the inspectors and a concerted effort to have the code definitely remove any ambiguities will help immensely. Dr. Bell prophesied that the most abominable lighting ever experienced would result if gas-filled lamps are not used with caution in residences, Dr. Luckiesh adding that careful consideration of shades would be imperative.

It was announced by S. G. Hibben, chairman of the committee on a residence-lighting bulletin, that the committee planned to prepare a booklet which would appeal particularly to the householder.

O. Hogue outlined the plans of the National Electric Lighting Association for a "more and better business" movement which will be continuous.

Specifications for luminaires were the feature of the report of the committee co-operating with fixture manufacturers, M. Luckiesh chairman. Dr. Luckiesh and P. S. Millar urged that criticisms and suggestions be sent in.

The Monday morning session was closed by an illustrated talk by J. W. Gosling on "How to Tell Period Styles in Fixtures."

### LIGHTING THE SCHOOLHOUSE

At the afternoon session on Tuesday the importance of better schoolhouse lighting, more intensive window illumination and a better selection of equipment in restaurant lighting was brought out. Prof. H. B. Dates, Cleveland, read a paper describing the equipment of a local school which served as a model for similar installations elsewhere. Tests showed 5 foot-candles to be the minimum desirable. Non-symmetrical fixture layouts and dust-proof unventilated globes were favored in the discussion.

Show window lighting was exhaustively discussed in the papers by Ward Harrison and H. T. Spaulding and W. Sturrock and J. M. Shute. The value of spotlighting and curved glass in correcting external reflection was brought out, and the greater drawing power of intensive lighting supplemented by color effects was emphasized.

J. L. Stair, in a paper upon "The Lighting of Public Eating Places," emphasized the varied equipment available for this class of service and the successful efforts of modern designers to avoid glare in dining rooms.

A paper on the hygienic effects of proper artificial lighting in food industries by W. H. Rademacher drew forth discussion on other applications of lighting to this industry, the stimulation of interest which investigations create, and the importance of dust-proof fixtures with large radiating surface in grain elevators.

John W. Lieb presented a paper giving the results of tests of tungsten lamps upon alternating and direct current, under the auspices of the Association of Edison Illuminating Companies. These tests showed differences in life or efficiency of little commercial importance, although in general the lumens of 100-watt gas-filled lamps at three-quarters total life was 3 to 5 per cent lower on direct current. In the case of vacuum lamps the watts are about 1 per cent higher and in gas-filled lamps about 1 per cent lower when run upon direct current.

Steps toward the establishment of a museum of lighting appliances were forecast in a vote authorizing the council to consider this project.

Twenty-five stores have pooled their lighting problems for the investigation of the industrial hygiene department of the Harvard Medical School, said Dr. A. B. Emmons, 2d, of Boston, in a paper on "Office Lighting from the Viewpoint of Hygiene."

The fallacy that daylight costs nothing was well riddled by M. Luckiesh and L. L. Holladay, Cleveland, in a paper upon "The Cost of Daylight." Comprehensive figures were presented showing that in many cases the cost of artificial illumination is lower than of providing for daylight through extra building construction, and in any case it is seldom enough higher than daylight costs to preclude a more liberal attitude toward investment in equipment for artificial lighting.

The demands of the motion-picture industry upon the electrical engineer were outlined in a paper by F. S. Mills on lighting for motion-picture studios.

On Wednesday evening a most interesting symposium reviewing the past fifteen years' development in illumination was contributed to by authors of papers at the first I. E. S. convention, namely Messrs. Sharp, Millar, Marks, Bell, Ryan, Hale, Blood, Morrison and Walker.

The papers presented on the last day of the convention, Thursday, were chiefly on photometric subjects.

### SPECTACULAR LIGHTING PLEASES

On Tuesday evening the hotel and adjacent shore were brilliantly illuminated by searchlights, floodlights and a 100,000-cp. incandescent lamp, combined with special float and transparency effects in plain and colored rays. Through the courtesy of the United States Navy Department the destroyer F. Fred Talbot was anchored off shore and illuminated in outline. Ornamental posts illuminated with the emblem of the I. E. S. were a feature of the hotel grounds. Many thousands of motorists and pedestrians attended the display, which was arranged by engineers of the Lynn works of the General Electric Company, with the co-operation of the United States Army.

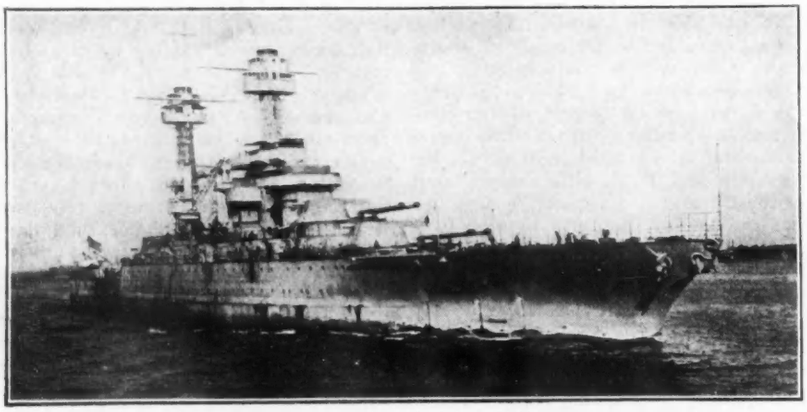
## High Praise for Ship Drive

**Commander of Battleship Maryland Finds It Far Superior to Other Drives in Storm**

SAILING from Rio de Janeiro, Brazil, on Sept. 13, with Secretary of State Hughes, who represented the United States at the opening of the Brazilian centenary celebration, on board, the United States battleship Maryland dropped anchor in the Hudson River last Saturday after a record trip of 4,760 miles up the Atlantic Coast. In the course of her voyage the Maryland ran at full speed through a severe gale, the wind reaching 75 miles an hour and heavy seas pouring over the vessel's decks. Her ability to perform this feat was attributed by Admiral Hilary P. Jones and Capt. David Foote Sellers to the electric drive with which she is equipped.

"I did not realize until this trip how superior the electric drive is to anything else," said Admiral Jones.

"It is the most efficient driving force on any war ship, in economy, power, ease of handling. I have been amazed by the performance."



UNITED STATES BATTLESHIP MARYLAND, ELECTRICALLY DRIVEN

Captain Sellers, commander of the ship, said that the time from Rio to the Ambrose Light was four hours under the previous record.

"The storm proved the value of the electric drive," said Captain Sellers. "That is automatically regulated, so that no matter what seas we plow into the speed of the ship is maintained. During the storm we sometimes brought up against seas as if they were brick walls, but the Maryland went right through them. We only lost eight-tenths of a knot at any time during the worst of the blow.

"The engineer officer told me that at one time when we ran up against seas that checked our way there was 8,000 more horsepower generated to bring the speed up to the normal 18 knots and keep it there. The automatic governor takes care of that, and all that is necessary is to set the motors at the desired number of revolutions, and they keep that speed. There is no racing, either, when the screw lifts from the water.

"The ship picks up like a subway express. When we left the anchorage at Rio we set the motors full speed ahead and she started off like a racehorse. We passed a Japanese ship 800 yards from our anchorage, and we were then going eighteen knots. She is the best ship in the world."

The Maryland, which has a displacement of 32,000 tons and is 624 ft. in length, was completed in 1920 and was the fourth capital ship of the United States Navy to install electric drive. Her electrical equipment was manufactured by the General Electric Company. It consists of two turbo-generator units rated at 11,000 kw. each, one control board, four 7,000-hp. propeller motors of the induction type and six 300-kw. exciter sets.

## New Insull Company to Care for Small Security Buyer

The investment departments of the Commonwealth Edison Company, the Public Service Company of Northern Illinois and the Middle West Utilities Company are being superseded by a new investment banking corporation under the name of the Utilities Securities Company, with rooms on the ground floor of the Edison Building at 72 West Adams Street, Chicago.

The new organization is the outgrowth of the success of the customer-ownership policy that has been followed by the Insull companies in the past few years. This business has grown in volume until the organization of a separate company to handle it has become a necessity. In discussing the new organization Fred H. Scheel, the vice-president and general manager, pointed out that the success of customer ownership has built up a list of 56,000 stockholders and approximately half that number of bondholders. He spoke of the difficulties in the way of expense that have prevented the investment banking houses from catering to the needs of the small investor and indicated that the object of the new organization is to do so. John F. Gilchrist, vice-president of the Commonwealth Edison Company, is the president of the Utilities Securities Company.

## Insull's Thirty Years' Work

**Commonwealth Edison Company Honors His Long Connection with Chicago Electric Service**

A DINNER commemorating the thirtieth anniversary of his connection with the Commonwealth Edison Company and its predecessor, the Chicago Edison Company, was given President Samuel Insull by the company officials at the University Club, Chicago, the night of Sept. 20. It was not only an anniversary celebration but a "welcome home" to Mr. Insull, who had spent ten weeks vacation in Europe. There were 170 persons present, including executives, heads of departments and older employees of the company.

The toastmaster was Louis A. Ferguson, vice-president in charge of construction and operation, whose employment dates back to 1888. John F. Gilchrist, vice-president, who came to the company in 1887, summarized Mr. Insull's achievements.

Mr. Insull, in responding, presented a vivid picture of the rise of the company. He told how he came to adopt the Wright demand system of rate charging as a result of a visit to Brighton, England, and how he adopted steam turbines for the Fisk Street station, which was the first all-turbine generating station in the world.

Mr. Insull predicted a further wonderful development of the central-station utility in Chicago in the next thirty years. Within twenty years he felt that the capitalization of the company would amount to $300,000,000 instead of half the sum, as at present. He declared that the foundation of his company was the close personal relations existing among the officers and employees.

## A. M. E. S. Schedule Meetings

The Associated Manufacturers of Electrical Supplies have issued a proposed schedule for the meetings to be held in New York City during the week commencing Oct. 16 as follows:

*Monday, Oct.* 16—Association rooms: General standards committee, 1:30 p.m. Old Colony Club: Radio Apparatus Section, 10 a.m.

*Tuesday, Oct.* 17—Association rooms: Heating Appliance Section, 10 a.m.; Snap-Switch Section, 10 a.m.; Laminated Conduit Products Section, 2 p.m.; Lamp Receptacle and Socket Section, 2 p.m.; Attachment Plug Section, 4 p.m. Old Colony Club: Radio Apparatus Section (all day), 10 a.m.; Industrial Lighting Section, 10 a.m.

*Wednesday, Oct.* 18—Association rooms: Fuse Section, 10 a.m.; Air Circuit-Breaker Section, 10 a.m.; Knife and Inclosed Switch Section, 2 p.m.; Molded or Formed Insulation Section, 2 p.m. Old Colony Club: Outlet Box Section, 10 a.m.; Rigid Conduit Section, 10 a.m.; Armored Cable and Flexible Conduit Section, 2 p.m.; Non-metallic Conduit Section, 3 p.m.; Metal Molding Section, 4 p.m.

*Thursday, Oct.* 19—Association rooms: Signaling Apparatus Section, 10 a.m.; Panelboard and Switchboard Section, 10 a.m.

*Friday, Oct.* 20—Association rooms: Meeting of board of governors, 2:30 p.m.

There will be a special meeting of the chairmen and secretaries of all sections with the president of the association on Monday at 7:45 p.m. at the association rooms.

# Mining Engineers for Automatic Substations

### Huntington Meeting Records Them Also as Favoring Electric Welding, All-Rubber Insulation and Steel Grids—Storage-Battery Locomotives Best for Work on Level

AT THE meeting of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers in Huntington, W. Va., on Sept. 19 to 22, a number of topics of interest covering electrical applications in the coal industry were discussed, including methods of distribution, relative merits of locomotives, automatic substations and hoists and the insulation needed on underground cables.

C. E. Von Sothen of the General Electric Company read an illustrated paper by M. A. Whiting on automatic substations and hoists, and C. J. Fuetter described in detail an automatic substation installation.

J. H. Edwards, in discussing the papers, said that four years ago his company had investigated automatic stations but got no encouragement from the manufacturers, while today there are about fifty installations in the mining industry. He was firmly convinced of the advantages of automatic control even to push-button starters on shop induction motors. George E. Suiter said that his company had operated a 100-hp. automatic hoist successfully for five or six years. C. J. Fuetter asserted that he would not use any substations that were not automatic because the automatic stations were cheaper, safer and more reliable.

In a discussion on bonding, opinion based on the experience of all present was to the effect that the electrically welded bond was best. H. E. Carlton said that a gang of three men was able to get 75 to 125 welded bonds per shift. It was conceded that a motor-generator welding outfit was the best to use in order to insure the positive condition on the rail necessary to a good welding operation, particularly on old rails.

#### Relative Merits of Locomotives

C. E. Rogers, in discussing the relative advantages of storage battery, combination and cable-reel locomotives in mine service, said that the storage-battery locomotive was best on the level, the combination on a combination grade and level, and the cable reel on steep grades. Thus each had its field.

J. H. Edwards said that the depth of vein affected the opinion of some engineers on the relative merits of the locomotives. It was also maintained that automatic charging methods should be used to reduce costs on battery locomotives. H. E. Carlton said his experience indicated a constant expense for maintenance on a 600-volt installation for cutting-machine service used independently of trolley-type locomotives, and he thought that lessened maintenance cost should be credited to them.

On Thursday F. M. Reigher read a paper on the comparative merits of cable insulation, his conclusion being that the all-rubber-covered type would give the best service, although its cost is great and the existing reels are not designed to the best advantage for using it. He stated that braided cable of the best quality gave six to eight months' service while the all-rubber-covered type lasted a year or longer. He particularly accented the fact that cable-reel design had not kept pace with locomotive design and said no satisfactory reel was yet on the market.

Robert Lee said his company had used rubber-covered cable for seven or eight years with great success. H. E. Carlton reported use of rubber-covered cable for the last few months, as did C. E. Rogers. N. A. Johnson said that his company was using it, but found difficulty in adapting it to the reels. J. H. Edwards asserted that the mining men of his company thought the all-rubber-covered cable gave better service.

A. F. Phelps held that it was reasonable to expect two or three times the life with all-rubber insulation that is obtained with braided insulation. H. M. McFarland pointed out that the length of life depended on five factors, the size of the conductor, the working voltage, the size and method of operating reels, the type of stranding and insulation, and the experience of the operator in handling cable. He emphasized the necessity for using large enough cables to withstand heating due to overloads and the importance of proper stranding to secure the necessary flexibility. F. M. Reigher said his experience indicated about 12 mills per ton of coal as the cost of using all-rubber cables.

#### Steel Grids Favored

Roscoe Woltz gave a paper on the relative merits of cast-iron and alloy-steel-plate grids for mine service. He listed many advantages of the steel grid and pointed out the disadvantages of the cast-iron grid. F. M. Reigher said the steel grids were best and that he had one that had been in use eight or ten years. J. H. Edwards said steel grids should be furnished by the locomotive manufacturers and the operators should not be compelled to rebuild locomotives after purchase. A. F. Phelps stated that the locomotive manufacturers would supply steel grids if specified by the purchaser.

George Suiter stated he had equipped eighteen out of thirty mine locomotives with steel grids with good results and expected to equip all the mining machines with steel grids. They were easy to repair and cheaper in the long run.

R. Dawson Hall read a paper by W. C. Shunk on how engineers could increase their usefulness. The paper pointed out many important things the engineer could do in the way of getting accurate cost records, reducing maintenance expense and decreasing mining costs.

On Friday M. W. Crenshaw gave a lecture on the wireless telephone and R. R. Webster presented a paper on insulating oils, which was well received. The following officers were elected: President, Roscoe Woltz; vice-president, R. R. Webster; secretary and treasurer, Herbert Smith. The executive committee will comprise: J. H. Edwards, F. M. Reigher, G. Suiter, J. J. Fluck and Henry Maxwell.

## Electrochemists Hear Papers on Industrial Heating

A successful meeting of the American Electrochemical Society was held last week at the Windsor Hotel, Montreal. At the opening session on Thursday industrial heating was exhaustively discussed. Dr. C. P. Steinmetz contributed a paper on the underlying principles of the problem, and among other papers presented were the following: "Electric Heat—Its Generation, Propagation and Application to Industrial Processes," by E. F. Collins; "Principles of High-Temperature Furnace Design," by E. J. Smalley; "Advantages of Industrial Electric Heating," by Wirt S. Scott; "Some Electrical Properties of Alloys at High Temperatures," by M. A. Hunter and A. Jones; "Resistivities of Some Granular Resistor Carbons," by C. E. Williams, and "Heat Insulating Materials for Electric Heating Apparatus," by J. C. Woodson.

On Friday the program included "Methods of Economically Handling Materials in Electric Furnaces," by Frank W. Brooke; "The Development of Industrial Electric Heating for Low-Temperature Enameling," by Wirt S. Scott; "Treatment of Ceramics," by E. T. Smalley; "Electric Annealing of Malleable Iron," by C. B. Gibson; "Electric-Steam Generators and Their Application," by P. S. Gregory; "A New Type of Induction Furnace," by J. Murray Weed; and "A Simple Electric Crucible Furnace for Melting Aluminum," by A. Glynne Lobley.

Among Saturday's papers was one on "The Relation Between Current, Voltage and the Length of Carbon Arcs," by A. E. R. Westman.

## Water Power to Be Main Topic of A. S. C. E. Convention

A discussion of water-power problems will be the main feature of the technical sessions at the fall meeting of the American Society of Civil Engineers, which will be held at the Palace Hotel in San Francisco, beginning on Wednesday, Oct. 4. The papers to be presented on that day include one on the development of the Colorado River by Arthur P. Davis of the United States Reclamation Service, one on the new development at Niagara Falls by Frederick A. Gaby, chief engineer of the Ontario Hydro-electric Power Commission; one on the present tendency of water-power development in New York State by John P. Hogan, con-

sulting engineer, New York, and one on the operation of the federal water-power act by Oscar C. Merrill, secretary Federal Power Commission.

On Thursday, Oct. 5, these papers will be presented: "Water-Power Potentialities of the Pacific Coast," by Frederick H. Fowler, United States Forest Service, San Francisco; "Hydro-Electric Developments on the Pacific Coast," by John D. Galloway, Consulting Engineer, San Francisco; "High-Voltage Power Commission," by F. W. Peek, Jr., General Electric Company, Pittsfield, Mass.; "High-Voltage Phenomena Encountered in Power Transmission," by Prof. Harris J. Ryan, Stanford University; "Growth of the Use of Electric Power in Southern California and Probabilities of Its Future Growth with Reference to Sources of Hydraulic Power," by Harry W. Dennis and H. A. Barre, Southern California Edison Company, and "Hydro-Electric Power Development as Related to Electrification of Railroads," by Charles F. Loweth, chief engineer Chicago, Milwaukee & St. Paul Railway.

On the evening of Friday, Oct. 6, there will be an informal dinner, when Charles D. Marx, professor of civil engineering at Stanford University, will talk on the social and economic aspects of hydro-electric power.

## Brief News Notes

**Work on Wilson Dam.**—The congressional appropriations for continuing the construction of Wilson Dam at Muscle Shoals have led to a resumption of work on an extensive scale, and it is expected that 2,400 men will soon be employed on the project, although new men are being added only as their services can be utilized to the best advantage.

**Muscle Shoals Helps Care for Shortage of Steam-Generated Power.**—The Alabama Power Company has been furnishing electrical energy for Georgia and the Carolinas through a tie-in at Gorgas from Nitrate Plant No. 2, Muscle Shoals. The plant at Muscle Shoals is reported as running full force in order to care for a shortage of power in those states due to the fuel situation.

**Algerian Water-Power Potentialities.**—Arrangements are being perfected to utilize the water of the "Plains of Cheliff" in Algeria for irrigation and water power. The amount of water which is estimated to be available is about a billion cubic meters in dry years and as high as twenty billions in years when the rainfall is heavy, says the electrical division of the Department of Commerce.

**Power Survey of Green River.**—A survey made to formulate a report on the power and reservoir possibilities of the Green River has recently been completed by a party which traveled 400 miles between Green River, Wyo., and Green River, Utah, in three especially constructed boats, spending several weeks on the trip. The party, which included H. L. Stoner of the Utah Power & Light Company, was in charge of R. R. Wooley, hydraulic engineer of the United States Geological Survey. Work on topographic maps of the river and reports will be begun at once.

**Electrical Show to Be Held in Pittsburgh.**—An electrical show will be held in Motor Square Garden, Pittsburgh, beginning Nov. 4 and continuing for one week. The show, which will be the first held in that city in several years, will be sponsored by the Electric League of Pittsburgh. Paul D. Lockard of the Duquesne Light Company has been appointed general manager of the show. One hundred and sixty exhibitors will have exhibits, and elaborate electric lighting and decorations will be provided to make the setting an attractive one for those who attend. The exhibit booths will be placed on the first and second floors.

**Official Figures on French Water Power.**—Replying to written questions from members of the Chamber of Deputies, the Minister of Public Works of France recently put the existing installed capacity of hydro-electric developments in that country at 2,100,000 hp., divided as follows: For lighting, serving small motors and heating, 650,000 hp.; for industrial, electrometallurgical and electrochemical plants, 1,300,000 hp.; for agricultural and other purposes, 150,000 hp. Besides this, he estimated that within two years an additional 300,000 hp. will be installed in power houses now under construction. Concerning the electrification of steam railroads he said that, although only 74 miles have been electrified since 1918, before the expiration of five years 930 miles will be added. The program adopted calls for the electrification of more than 5,500 miles within fifteen or twenty years.

**Rural Service in Wisconsin.**—Construction of a 66,000-volt high-tension transmission line extending 75 miles from Dane, Wis., through Columbus and Beaver Dam to Fond du Lac and connecting with the hydro-electric plant of the Wisconsin Power, Light & Heat Company on the Wisconsin River at Prairie du Sac, nears completion, 55 miles of poles having already been erected between Dane and Fond du Lac. It is expected that all wires will be strung by Nov. 1. The company is also preparing to furnish farmers with light and power service by placing on its poles a service wire in addition to the main cable. Power cannot be taken from the high-tension wire in the country, but will be supplied farmers living along the power line from these service wires strung out from the cities or villages. The cost of installing transformers outside of cities or villages would be prohibitive, company officials declare.

**Building a Dam by Electricity.**—In order to use electric power in operating dredges and other equipment in the construction of the big dam and irrigation project of the Wichita Valley Irrigation District a transmission line has just been built from the plant of the Wichita Falls (Tex.) Electric Company to the site of the dam, 41 miles, at a cost of $90,000. The dam for the main reservoir is being constructed throughout by motor-driven pumping equipment mounted on a huge barge. Motor-driven centrifugal lamps suck up the mixture of mud and water and throw it into place on the dam through a string of 40-in. piping which is floated between the barge and the dam on small skiffs, these skiffs and the main barge being in the main lake. The barge equipment requires 2,100 hp., the main motor driving the centrifugal slush-pumping unit is rated at 1,600 hp., and the operation of auxiliary barge equipment takes 500 hp.

## Associations and Societies

**Arkansas Utilities Association.**—To avoid conflict with other conventions, the date for the meeting of the Arkansas Utilities Association at Hot Springs, Ark., has been changed from Oct. 9-10 to Nov. 7-9.

**New Orleans Electric League Promotes Good Will.**—The New Orleans Electric League recently gave a "central-station night," designed to promote good will and get the electrical story before the citizens. It took the form of a dinner and entertainment, interspersed with talks by electrical men, including Frank G. Frost, W. E. Clement, W. J. Aicklen, Jr., and F. J. Schwab.

### Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

American Welding Society, Chicago, Oct. 2-5.
American Electric Railway Association—Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.
Empire State Gas and Electric Association—Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.
American Society of Civil Engineers—San Francisco, Oct. 4-8.
Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Oct. 6. E. Donald Tolles, 165 Broadway, New York.
Society of Motion Picture Engineers—Rochester, N. Y., Oct. 9-12.
Association of Edison Illuminating Companies—White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.
National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St., New York.
Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 20-21. A. Bliss McCrum, Charleston, W. Va.
Electric Power Club—Asheville, N. C., Oct. 30-Nov. 2. S. N. Clarkson, Kirby Bldg., Cleveland, Ohio.
Arkansas Utilities Association—Hot Springs, Ark., Nov. 7 and 9. R. P. Brown, Little Rock Ry. & Electric Co., Little Rock.
Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.
National Association of Railway and Utilities Commissioners—Detroit, Nov. 14-17. J. B. Walker, New York Transit Commission, New York.

# Recent Court Decisions

**Contract Entered Into Prior to Commission Law Is Not Exempt from Order of Commission.**—In Clute vs. Nassau & Suffolk Lighting Company the New York Supreme Court has held that a gas company's contract with a private individual, fixing the price of gas to be furnished him, entered into prior to the grant by the state to the Public Service Commission of the power to fix rates, did not make a commission order fixing rates for the company inapplicable to such individual, the contract having been entered into with knowledge of the power of the state to regulate rates. (195 N. Y. S. 84.)*

**Supreme Court of Florida Reverses Judgment Awarding $18,000 for Death of Husband.**—A jury in Davis vs. Southern Utilities Company awarded $18,000 to a widow for the death of her husband while in the employ of the company named. Finding that the evidence as to reasonable damages, based on loss of support. earning capacity of the husband and so forth, was fragmentary and lacking in material particulars, and declaring that the determination of the amount of damages is by no means to be left to the uncontrolled discretion of the jury, the Supreme Court of Florida reversed the judgment and ordered a new trial. (92 So. 683.)

**Damages Granted for Backwater from Power Company's Embankment.**—An action was brought by one Peerenboon against the Wisconsin Traction, Light, Heat & Power Company for damages to his land caused by the backing up of water due to an insufficient opening to carry a stream through defendant's railway embankment. The company held that there was no negligence as the physical facts showed the railway structure to have been erected so as to take care of every contingency, but the Supreme Court of Wisconsin took issue with the statements of the company's engineers and affirmed the finding of the trial court for the plaintiff. (189 N. W. 267.)

**Utilities Do Not Surrender Proprietary or Contractual Rights by Accepting Extension of Charter.**—A suit brought by the city of Portsmouth against the Portsmouth Gas Company and decided in favor of the defendant was appealed to the Supreme Court of Appeals of Virginia and judgment affirmed. The city claimed that the charter of the company had lapsed. The court held that the amendment of a charter by extending it for a further period did not make a break in the corporate existence of the company and that a resolution of a municipal council granting to a company exclusive privileges for fifteen years did not expressly or by implication limit the right to use the streets to that space of time. Where, on the contrary, the company continued for more than sixty years to use the streets it had the municipality's consent to their use for an indefinite period. In construing grants of the right to the use of the streets reasonable and just protection will, the court said, be extended to public utility corporations, whose investments are necessarily based upon calculations of future growth and development. (112 S. E. 792.)

**Concrete Instruction on Contributory Negligence Must Be Given to Jury if Necessary to Present Defense.**—In remanding for new trial the case of Morris vs. Kentucky Public Service Company the Court of Appeals of Kentucky declared that it was an error for the trial court to refuse to give the jury a concrete instruction on the issue of contributory negligence. The case concerned the fatal injury from electric shock of a lineman in the company's employ. It was not denied that he had neglected to wear rubber gloves, contrary to the orders of his employer, but it was asserted that the injury had not been received through his hand and was due to the company's negligence in not properly insulating its lines. In proof of this it was asserted that another lineman who wore, like the victim, only leather gloves had cut the wire to release the latter without receiving any injury. The Court of Appeals held that the jury should have been instructed to the following effect: "You will find for the plaintiff unless you believe from the evidence that the transmission of the current through decedent's hand was the proximate cause of his death." (242 S. W. 599.)

**Voluntary Payment Does Not, as a Matter of Law, Defeat Recovery of Overcharges.**—The Supreme Judicial Court of Massachusetts has found, in City of Boston vs. Edison Electric Illuminating Company of Boston, that under the statutes a dissatisfied customer of a public utility is limited to the means of redress provided through the Department of Public Utilities and cannot sue to recover alleged overcharges in excess of reasonable rates. When legislation covers the entire field the provisions of the common law in conflict therewith are no longer in force. Under the statutes the Department of Public Utilities may be petitioned for an inquiry into prices by the Mayor on complaint of one customer. The Supreme Court further found that where a city suing to recover alleged overcharges for electricity alleged that it was dependent on the furnishing of electric light and power by defendant, and unable properly to perform its municipal and corporate functions if the obtainment of such electric light and power from defendant was interrupted, the doctrine of voluntary payment presented no defense as a matter of law, as it could be found that the circumstances created a necessity of payment as the only means of immediate relief. (136 N. E. 113.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

**Extensions by Overloaded Utilities.**—A petition brought by customers of the Batesville Electric Light & Power Company to compel it to furnish additional power service has been dismissed by the Indiana Public Service Commission upon a showing that there was another source of power available and that the plant of the utility was overloaded. "An order," observed the commission, "which would necessitate enlargement of the capacity of respondent's plant would possibly entail an expenditure so great that it might be reflected in the rates which respondent would be entitled to receive and thus work a hardship upon the great body of consumers in Batesville and its vicinity."

**Overbuilding of Plant.**—In ordering the Adirondack Power & Light Corporation to reduce its gas rates in the city of Oneida the New York Public Service Commission made some observations on the unnecessarily large plant of the company, in part as follows: "A real issue in this case is: Was it a wise and prudent investment for this company to build such a plant in view of existing conditions and future probabilities? The consuming public in Oneida evidently had cause to demand better service than the old coal-gas plant could furnish. The company claimed that the present plant represents a sincere effort on its part to remedy the situation formerly existing. . . . It seems well settled that a utility which is overbuilt should be permitted to charge such rates as will produce sufficient revenue to meet its operating expenses, create a proper depreciation reserve and leave a fair return upon such part of the investment as is necessary to serve the territory in which it operates. . . . It probably is more economical to construct a large plant in entirety than to add from time to time as business increases. A plant constructed as an entirety is usually more efficient, certainly more harmonious in structure and undoubtedly more economical in operation. It is also the duty of public utilities to take account of the probable increased demand due to growth in population; and some latitude must be allowed for prudent overbuilding of plant, lest the necessary capital be kept away from utility investment. But in the instant case the company admits that its plant is four times greater than present needs require. . . . If this company were allowed a full return and in order to get it could charge whatever rate is necessary, it might thereby become relieved of the necessity of prudent and economical management and be enabled to pass the burden of its mistakes or misjudgment on to the consumers. This should not be."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## Luncheon for Dr. Giolitti

Dr. Federico Giolitti, Italian metallurgist, was the guest of honor at a luncheon at the Bankers' Club, New York City, last Tuesday, where he was met by members of the iron and steel committee of the American Institute of Mining and Metallurgical Engineers. Dr. Giolitti, who is revisiting America, was managing director during the war of the great Ansaido works at Genoa. He is a son of the Prime Minister of Italy. Dr. Giolitti's visit to America is regarded as of more than ordinary importance by American engineers who are entering into a plan of international co-operation with the engineers of Italy. This plan was furthered during the recent visit to Italy of John W. Lieb, vice-president of the New York Edison Company, who made the trip as the emissary of the American engineering profession.

**Frank S. Clark**, associated with the Stone & Webster Engineering Corporation, Boston, has been elected chairman of the Boston Section of the American Society of Mechanical Engineers. He succeeds Alfred S. Kellogg.

**W. H. Richardson**, manager of the Brattleboro (Vt.) office of the Twin State Gas & Electric Company, was elected a member of the executive committee of the New England Division of the National Electric Light Association at the recent New London meeting.

**James Orr** has been appointed assistant superintendent of power for the Hartford (Conn.) Electric Light Company, with headquarters at Hartford. For the past fifteen years Mr. Orr has been in the employ of Stone & Webster, Inc., as a power-plant expert, the last five years having been spent as an engineer in the betterment division.

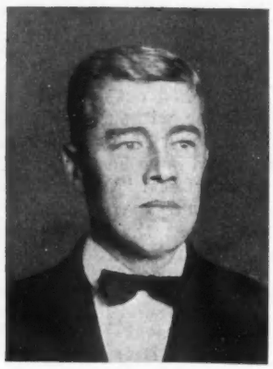
**E. M. Knight**, who for the past several years has been resident engineer in Parkersburg, W. Va., of the Monongahela Power & Railway Company, has been promoted and will have headquarters at Fairmont, W. Va., as assistant to the chief engineer of the system. Mr. Knight will be succeeded by Howard Carr of Fairmont.

**Dr. Otto Feuerlein**, to whose work is attributed the tantalum lamp that led up to the tungsten filament, recently arrived in this country and will visit a number of American lamp plants. Dr. Feuerlein is connected with the Osram Company, Berlin. He has not been in the United States since 1913, but is well acquainted with a number of the leaders in the American lamp industry.

**A. H. Anderson** recently returned from Haiti, where he acted as electrical engineer with the Haitian American Sugar Company and assistant superintendent of the Port au Prince Electric Light Company. Prior to his work in Haiti he spent about five years in South America, two years on the west coast with the Chile Copper Company, and the rest of that time with the Armour interests as electrical engineer in charge of construction, in the building of packing plants, eighteen months being devoted to work in Patagonia.

## R. B. Gerhardt President of A. I. and S. E. E.

R. B. Gerhardt, the new president of the Association of Iron and Steel Electrical Engineers, has been associated



R. B. GERHARDT

with the Bethlehem Steel Company as electrical superintendent of the plant at Sparrows Point, Md., in charge of design, construction and operation, since 1913. Mr. Gerhardt was born in Martinsburg, W. Va., Aug. 2, 1884, and at the age of sixteen was employed as an electrician by the Pennsylvania Steel Company, Steelton, Pa. He entered Pennsylvania State College, but at the end of his sophomore year transferred to Cornell University, from which he was graduated in 1907 with the degree of M. E. He then returned to the Pennsylvania Steel Company as electrical construction foreman at the Steelton and Lebanon plants. For four years previous to his connection with the Bethlehem Steel Company Mr. Gerhardt was electrical and mechanical engineer on development, construction and operation of iron-mining property for the Spanish-American Iron Company, Felton, Cuba. Mr. Gerhardt has been active in the affairs of the A. I. E. E. and of the A. I. and S. E. E. for the past two years.

## Committee Chairmen of Northwest Power Association

President Brockett of the Northwest Electric Light and Power Association has named the following as chairmen of the four principal committees of the association:

George F. Nevins, secretary and treasurer Pacific Power & Light Company, Portland, chairman executive committee Accounting Section; Lewis A. Lewis, sales manager Washington Water Power Company, Spokane, chairman executive committee Commercial Section; George L. Myers, assistant to the president Pacific Power & Light Company, chairman executive committee Public Relations Section; R. M. Boykin, vice-president and general manager North Coast Power Company, Portland, chairman executive committee Technical Section.

**Don Stearns** of Humbolt, Iowa, was recently elected second vice-president of the Iowa Section of the N. E. L. A.

**Dr. Arthur E. Kennelly**, professor of electrical engineering at Harvard University and the Massachusetts Institute of Technology, who has been in France as exchange professor in engineering and applied science during the past year, returned Saturday, Sept. 23. While in France Dr. Kennelly was honored by the French government with the cross of the Legion of Honor.

**S. Glen Vinson**, vice-president and general manager of the Ideal Electric & Manufacturing Company of Mansfield, Ohio, has just returned from a very extensive trip through the Orient, where he made a careful survey of business conditions. Mr. Vinson visited all the prominent cities in the Hawaiian Islands, Japan, China and India and returned by way of the Suez Canal, visiting Egypt, Italy, Switzerland, France and England.

**S. E. Doane** and **M. D. Cooper** of the engineering department of the National Lamp Works of the General Electric Company embarked for Europe on the *Olympic*, Sept. 23. They will visit England, France, Austria, Germany, Holland, Switzerland, Norway, Sweden and Italy to investigate the problems and progress of the lighting industry in those countries. The offices of the International General Electric Company at Paris will be their headquarters. They plan to return to this country at Christmas time.

**Arthur W. Ambrose** has been selected to succeed E. A. Holbrook as assistant director of the United States Bureau of Mines. Mr. Ambrose has been in the service of the bureau since 1917, during which time he has risen through the various grades from petroleum technologist to chief of the petroleum division of the bureau. His technical education was obtained at Stanford University, where he obtained his mining engineer's degree. Prior to his connection with the Bureau of Mines he was in the service of the Dutch Shell and other petroleum companies.

## Radio Corporation Elects David Sarnoff Vice-President

David Sarnoff was elected vice-president and general manager of the Radio Corporation of America at a recent meeting of the board of directors. Mr. Sarnoff, who is only thirty-two years old, has been associated with radio activities for more than sixteen years and with the Radio Corporation of America since its organization. An early exponent of the broadcasting idea, Mr. Sarnoff ranks as one of the foremost workers in the radio industry.

**R. F. Gooding**, formerly chief engineer of Winthrop College, Rock Hill, S. C., is now associated as electrical engineer with Charles B. Hawley & Company, Washington, D. C., consulting engineers on water-power development.

**B. L. Conley** has resigned as instructor in electrical engineering at the Case School of Applied Science, Cleveland, and is now electrical engineer of the Hoover Suction Sweeper Company, North Canton, Ohio.

**R. Philip Hart**, who recently resigned his position as head of the standardization laboratory of the Hartford (Conn.) Electric Light Company, has been made manager of the Cazenovia (N. Y.) Electric Company.

**Henry H. Plum**, formerly connected with the electrical division of the United States Reclamation Service in Denver, Col., has been transferred to the Minidoka Project, Idaho, as assistant in charge of the power system.

**J. P. Hickey**, chief accountant of the Australian General Electric Company of Sydney, recently passed through San Francisco en route to the Schenectady plant of the parent company. It was Mr. Hickey's first visit to the Pacific Coast.

**P. H. Falter**, the new vice-president and treasurer of the Electric Furnace Construction Company, Philadelphia, is a graduate of the engineering department of the University of Michigan and until recently was vice-president and general manager of the Canadian Electro Products Company, Quebec. Prior to his connection with that organization he was general manager of the Baltimore Electric Alloys Company and for thirteen years with the Aluminum Company of America. Mr. Falter was also general manager of the Shawinigan Electro Metals Company, Montreal, and has had considerable experience on hydro-electric power-plant work.

**Herman K. Ansingh** has been selected as the Canadian representative of Ferguson, Pailin, Ltd., of Manchester, England, manufacturers of switchboards and switching equipment, who are opening an office and warehouse in Canada. In entering the Canadian field the British firm has intrusted its interests to an engineer of wide experience on both continents, for Mr. Ansingh was formerly chief switchboard and switching-equipment design engineer of the British Westinghouse Company and until recently has been switchboard and equipment-design engineer for the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. He is a member of the American Institute of Electrical Engineers and an associate of the (British) Institution of Electrical Engineers.

**J. Louis Daeuble**, for many years engaged in the electrical supply business, has become vice-president and treasurer of the Wood-Reinecke Electric Company, the firm organized by the late Harry I. Wood immediately preceding his death. Mr. Daeuble was manager of the Harry I. Wood Electric Company for ten years. During the past three years he has conducted an electrical business of his own under the name of the Electrical Sales Company.

## R. S. Mitten Appointed Branch Manager

R. S. Mitten, formerly sales manager of the Electric Appliance Company, Chicago, has been appointed branch manager for the Black & Decker Manufacturing Company in Chicago. In his new office Mr. Mitten is succeeding

R. S. MITTEN

W. C. Allen, who has been selected to be sales supervisor for the Black & Decker Company. The territory which is to be in Mr. Mitten's charge consists of the States of Illinois, Iowa, Wisconsin, Minnesota and North Dakota, the eastern half of Missouri, including St. Louis, a small corner of Indiana, taking in South Bend, and the western end of Michigan.

**M. G. Linn**, Des Moines, Iowa, was recently elected secretary-treasurer of the Iowa Section of the N. E. L. A.

**H. M. Hicks**, formerly local manager at Leeds of the Alabama Power Company, has been promoted to be district manager of the Ashland district.

**William L. Higgins**, for the past five years connected with the sales department of the Stuart-Howland Company, Boston, and prior to that for eleven years with the Belcher & Loomis Hardware Company, Providence, has become connected with the Providence office of the Western Electric Company, Inc.

## C. W. Horn Will Take Charge of Westinghouse Radio Operation

C. W. Horn, manager of the radio division service department, Westinghouse Electric & Manufacturing Company, has been appointed as superintendent of radio operations of the Westinghouse company. Mr. Horn succeeds L. R. Krumm, who left the service of the Westinghouse company to become manager of the radio department of the Erner-Hopkins Electric Company, Columbus, Ohio. In his new position Mr. Horn will have charge of all radio operations of the Westinghouse company, including the company's four radio broadcasting stations, at East Pittsburgh, Pa., Newark, N. J., Chicago, and Springfield, Mass. Mr. Horn has been interested in radio for the past thirteen years and knows every phase of radio development. His work in this field has taken him to South America, Central America and the West Indies. For the present Mr. Horn will continue as manager of the radio division service department.

**W. H. Cogswell**, formerly with the Miller-Owen Electric Company, Pittsburgh, has become associated with H. F. Randolph, consulting electrical engineer, Oliver Building, Pittsburgh.

**H. Owesen**, formerly mechanical engineer of the Apollo Steel Company, has become assistant chief engineer of the Youngstown Sheet & Tube Company.

**George Roome Smith**, formerly associated with the safety-switch section of the Krantz Manufacturing Company of the Westinghouse Electric & Manufacturing Company, Brooklyn, N. Y., has recently severed his connection with that department. The department will hereafter be known as the safety switch section of the Westinghouse Electric Products Company and is being transferred to Mansfield, Ohio, where W. G. Balph will be manager.

## Obituary

**Albert F. Dow**, for many years president of the Fall River (Mass.) Electric Light Company, died Sept. 20 at Fall River. Mr. Dow retired from active business in February, 1922.

**Jasper N. Keller**, former president of the New England Telephone & Telegraph Company and a close associate of the late Theodore N. Vail in the upbuilding of the Bell system, died Sept. 22 at Surry, N. H. Mr. Kellar was born at Burlington, Iowa, in 1846. His career embodied varied experiences in mining, railroad work and telegraphy in the pioneer days of the Far West. He entered the telephone field in 1880 at Ogden, Utah, and four years later went to Boston, where he soon became general manager and then chief executive of the New England company.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## A Review of the Jobber's Rôle—Part I

### The Many Important Functions Which Are Filled by Him Serve Materially to Lessen the Burdens Imposed on Both the Manufacturer and the Dealer

THE following comments on the service which is rendered by the stocks of the electrical supply jobbers concentrated at centers of population throughout the country have been contributed from various sources and have been gathered together under appropriate general heads, but without any attempt to knit them into a narrative. They are presented rather as the opinions of many men on the practical usefulness of this service element in the machinery of distribution.

#### Economy in Investment

A well-equipped jobber can make delivery from one local stock at minimum expense in time and money of many small items used in electrical work in the building trades and in connection with the maintenance and operation of the country's manufacturing and various commercial activities. Literally, thousands of small items in the electrical supply line are unnecessary requirements of various classes of electrical work. While individually these items are of minor importance, they would qualify collectively as an uneconomic and unbearable stock-carrying burden for the installer or user should he attempt to have a working quantity of a representative number of them on hand in his own stock at all times.

Electrical supply jobbers' stocks serve as an effective influence in reducing investments in miscellaneous stocks of electrical materials carried regularly by the various public service corporations, dealers and contractors. Should the jobbers' stocks be withdrawn, they would each find immediate necessity for investing additional millions of dollars in stocks of supplies beyond what is now available in jobbers' stocks subject to the call of any and all local users, and on this extra investment the public must pay.

Were it not for the concentrated stocks in the hands of the jobbers, the central stations and contractor-dealers would necessarily have to increase their investment in merchandise materially in order to have the necessary materials on hand to do their jobs promptly and efficiently. This would make impossible the quick turnover of the contractor's investment and materially increase his cost of doing business.

The investment in jobbers' stocks is undoubtedly much less than would be the investments in goods in transit and increased customers' stocks due to purchases direct from manufacturers. This elimination of investment in customers' stocks results in a great saving in interest, warehousing, accounting, trucking, handling, depreciation, obsolescence and breakage, and because of all this the public is bound to benefit.

Great savings are made by purchasers of electrical materials owing to the lack of delay in obtaining materials, prompt adjustment of claims and prompt billing, and dealers and contractors gain the opportunity of turning over their stocks more quickly and are enabled to conduct their business on less invested capital.

We all know that proper merchandising means the carrying of stock for which there is a demand and on which a reasonable profit can be obtained at a minimum investment expense and on which the necessary turnovers during the year can be obtained.

#### Purchasing Service

The full-fledged electrical supply jobber functions economically as purchasing specialist for the common bulk items used in electrical construction of all classes. He also functions economically on warehousing operations and in the delivery of starting quantities and finishing quantities, as well as supplying shortages necessitated through changes in construction programs or unexpected modification of building or other construction plans.

If it were not for the jobber, the consumer would either be obliged to buy his material direct from an infinite number of manufacturing plants, at higher prices, because of his small potential purchasing possibilities to each individual manufacturer, and with a longer delivery period, or he would have to buy from a similar number of local stocks, if the manufacturers attempted to maintain their own local stocks, at a still further increased cost by reason of the expensive distributing expenses of the manufacturers.

The jobber protects the consumer from poorly designed and manufactured products and from irresponsible manufacturers.

#### Delivery Service

An electrical supply jobber in preparing to serve a more general demand from a recognized distributing center can and does justify carrying a working quantity of these numerous items in his stock, and can deliver them promptly in accordance with the requirements of the job as it progresses and at lowest costs to all concerned.

It would be impossible to carry on the operations in the electrical industry in all its present proportion without these concentrated stocks. The success of all large operations, whether military or industrial, is dependent upon the reliable supply base from which materials and other essentials for carrying on the work can be obtained.

Bearing in mind that even the simplest electrical installation requires a great variety of such products produced from nearly as many different sources, the importance of the electrical supply jobber's economic necessity becomes increasingly apparent when the electrical industry as a whole is considered.

Emergency service from jobbers' stocks is an ever-ready aid in restor-

ing operations of public service corporations whose properties and service are seriously crippled, as they frequently are in time of fire, flood, storm or disaster of any character. Jobbers' stocks also make it possible to meet various serious emergencies that often befall important industries in the larger centers.

### SALES SERVICE

A jobbers' selling organization can thoroughly and economically cover a territory in which very few, if any, manufacturers can operate because of the limited business available in any one line.

The jobber is or should be equipped to render practical engineering assistance to the trade through the collection and dissemination of data on electrical construction material requirements and their proper and economic uses. This same assistance rendered direct to the trade by manufacturers' representatives would be much more expensive to all concerned.

There are or should be trained salesmen in a position to serve the customer on any one of four or five thousand items and to counsel and advise him in an efficient manner on price, quality, application and service. Elimination of the jobber's salesmen would require twenty-five or thirty salesmen, each representing his respective line. This would add more to the selling cost than the direct-from-factory service warrants.

Behind the trained salesmen stand the experts specializing on specific lines, whose services are available to dealers, contractors and industrial plants in their engineering and sales problems.

The jobber should have creative salesmen who will constantly increase the number of users of electrical merchandise by advocating wiring of old houses, convenience outlets, appliances, better lighting, etc. While it is true that the manufacturer can and does to some extent advertise to inform the public regarding his own particular material, it is the jobber and the jobber's representative that carry the word-of-mouth information direct to the trade regarding the latest and best electric development.

The jobber, because of his location and the nature of his business, obtains the confidence of the consumer, a confidence it would be impossible for the manufacturer to gain.

It would be physically impossible for the retailer to carry in stock a complete line of commodities so as to be in a position to care adequately for the requirements of the consuming public. Inasmuch as the manufacturer is usually interested in but one class of product, it has been demonstrated that an intermediate step is necessary to carry economically the many and miscellaneous lines and thus relieve the retailer of the burden of an excessive variety of stocks.

The jobber needs successful dealers to complete his lines of distribution and must make the dealer successful in all the lines he handles. He must see that the dealer is running his business economically and that he is allowed enough margin in the lines he handles to enable him to live.

The jobbers are of benefit to the consumers in that the profits made by the jobbers are retained in the community providing those profits.

# Why Not Develop a True Electric Range?

**Universal Electric Cooking Can Be Brought Materially Closer by the Simplification and Cheapening Inherently Possible, if Traditions of Coal, Gas and Oil Are Shaken Off**

BY A MANUFACTURER

WITH dealers aggressively demonstrating and displaying electric ranges, central-station companies making vigorous efforts to connect more of them to their lines and well-equipped and forward-looking manufacturers devoting their facilities to producing them, it seems time, not in spite of all this, but because of it, to point out that we still have no *electric* ranges, but simply an array of *electrified* ranges.

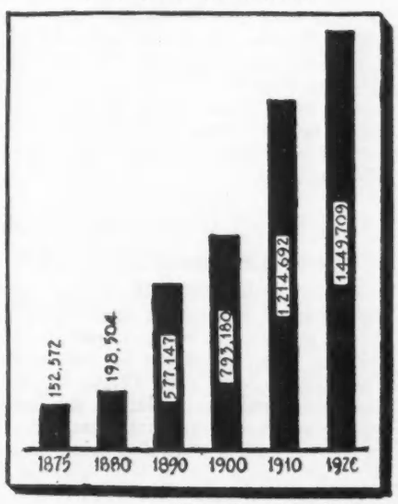
I have been inspecting some recently—nickel and white enamel, automatic control, fireless cookers, multiple-heat switching, individual fuses, removable elements, convenience outlets—impressively clean, impressively convenient, impressively economical. But what struck me most impressively is the fact that, stripped of their strictly electrical equipment, they are, in construction, design and general conception, directly adapted from ranges of other sorts.

Take as an example a range of well-known make in the "quality" class, turned out by an organization which produces nothing else. The model I inspected had three hot plates, an oven, a fireless cooker and a broiler, was handsomely finished, equipped with all recent control and other refinements, and sold for a little more than $200. Yet with its elements out, its switches off and its wiring removed any mechanic of average skill and ingenuity, and without expending too much time, could convert this range (with the possible exception of the fireless cooker) into a gas or kerosene burner, and possibly into even a coal burner, because its general construction and basic design are the same as these other types.

I realize, of course, that certain similarities are inevitable; that, for one thing, it would be difficult to sell women a range that broke too sharply from conventional appearance, and that certain common parts, like the top, are necessary regardless of the heat source. But with all the possibilities thrown open by electric heat it scarcely seems necessary to follow previous types so slavishly, particularly when this following has made itself a severe handicap to the electric range.

Take the single item of weight, for instance. The wiring and heating and control equipment of the range just referred to weigh perhaps 50 lb. The oven, cooker and broiler, with the structure necessary to sup-

## Growth of Wire Mileage in the United States




*Magazine of Wall Street*

Since 1875 there has been a tremendous growth of wire mileage in the United States, as shown by the above chart. Much of this growth has been due directly to the great increase in the use of electric energy.

port all with a load of utensils, weigh perhaps another 100 lb., making a permissible total of 150 lb. But this range, installed, weighs 350 lb., 200 lb. of excess material, represented not in surplus strength or durability, but in plates, housing and braces put on solely to give the illusion of coal or gas. The nameplate is even a panel embossed like an ash door, and one finds himself all but looking for the smoke pipe.

It is as if the electric locomotive carried a dummy boiler, the tungsten lamp were equipped with a chimney or mantel, and the electric motor with cylinders and crank shaft.

To be sure every development is certain to carry over some excess baggage from the thing it supersedes. The first automobiles were simply motorized carriages, the first railway trains steam-drawn stagecoaches, and the first steamboats engine-driven sailing craft. But the electric range, it seems, is now old enough and has gone far enough to become something of itself.

Electric cooking is finding gradually widening use. Its obvious cleanliness and convenience have aways recommended it powerfully, and with rates reduced to a point where the operating cost compares very favorably with that of fuel-fired equipment, it is not too much to expect that in the future electric cooking will be universal. But what postpones this time to something beyond the near future is the fact that electric equipment is considerably and admittedly higher in first cost than the fuel-fired type, and in this lies the real significance of present electric construction practice.

With the possibilities for simplicity and flexibility of construction thrown open by ease of control and intensive localization of heat, electric equipment should be, unit for unit, cheaper than all other types, once it breaks away from the traditions of coal, gas and oil and strikes out on a new path of design.

This would require boldness. Any innovation, and particuarly one that involves introductory selling, as this well might, requires that. But the reward not only to the manufacturer but to the entire industry seems worth the risk, for any one can see what universal or even "near-universal" electric cooking will mean to the manufacturer, jobber, contractor-dealer and central station.

Who will take the plunge?

# Survey of Business Conditions

## Reliable Radio Manufacturers Reduced Prices Sensibly

A leading manufacturer of radio appliances in Philadelphia states that current sales cannot compare with sales of six months ago, when the great interest in such apparatus was at its height, and that the tremendous amount of orders which were placed at that time was to a large extent either canceled or arrangements for gradual deliveries were made between the manufacturers and the jobbers.

"Deliveries can be made without undue delay, and we do not expect business to be such as to demand undue lengths of time to make shipments." he says.

"Prices have gone down compared with six months ago on most items, but not to nearly such an extent as would appear from quotations which are made from certain so-called manufacturers. The better class of manufacturers have made certain reductions, but in a systematic and sensible way. We do not anticipate any change in the near future.

"We think the outlet for the next six months is good because the cold season is conceded to be the best time for the sale of radio material.

"Paradoxical as it may seem, the tremendous setback which we had here in the past few months was most helpful to the reliable manufacturers, since the "fly-by-nights" could not stand the strain and a good many went out of the business as fast as they came in. This situation, of course, accounts also for some ridiculously low figures which are reported for certain items in the radio line—these items being mostly bankruptcy stocks or material from people who want to raise the cash to close up."

## Says Small Wiring-Box Sales Have Increased Materially

Current sales of small wiring boxes for armored conductors have increased very materially over those of six months ago, according to one manufacturer in New York City. He says that this condition is due to the heavy construction of the last summer. It is known among manufacturing circles that producers have been unable to meet the demand on account of the deliveries of raw material which have been made by some foundries, but that the outlook is improving every day. This manufacturer states:

"There have been no changes in prices; in fact we feel that prices are about stabilized, at least for the next six months, and our opinion is that business will greatly improve in the spring, but with a slackening from now until early in March."

## High-Class Construction Helping Refrigerators and Heaters

Reports to the housing division of the Department of Commerce indicate a slow swing in the construction of new buildings from the New York-New Jersey district to the Middle West with the center in Chicago. Throughout the country generally reports indicate a continuation of the tendency to erect dwellings and apartment houses of the higher class. This situation, it is pointed out, is particularly satisfying to manufacturers of refrigerators, electric heaters and high-grade appliances of all kinds.

The rate of construction contracts has been high since March, according to the reports, and present activities probably will carry the building industry through well into cold weather. There is no indication thus far, according to the housing division, of the effect of increasing prices of construction upon future contracts.

## Chile Promises Good Market for American Radio

Chile is sending inquiries to the Department of Commerce relative to the development of the radio industry in this country. Several manufacturers in New York City are in receipt of letters from business men in the South American country asking about standard material and its price. It seems probable that before long serious consideration will be given to the exploitation in Chile of this new development, according to Commercial Attaché Charles A. McQueen at Santiago.

Legislation is now contemplated in Chile, he says, based on the laws of the United States. Although it does not provide specifically for the establishment of broadcasting stations by private enterprise, it is possible that this service will be available through the leasing of government-owned stations during times of peace.

## Record-Breaking Heater Sales Are Reported

Within the past few weeks the demand for electric heaters has risen by leaps and bounds under the stimulus of the domestic fuel situation, and the outlook for the year's business is record-breaking, according to R. P. Ingalls, sales manager Simplex Electric Heating Company, Cambridge, Mass.

To a representative of the *Electrical World* Mr. Ingalls said last week that the company is running on full time and that accumulated stocks of heaters manufactured earlier in the season

against the present demand are being rapidly diminished. In fact, rationing of heaters delivered for resale has become necessary. The supply of raw material for present needs is satisfactory.

The demand is well distributed over the country north of Washington, D. C., and St. Louis. Sales so far this season are easily treble those of a year ago.

## The Metal Market

### Domestic Copper Demand Active—Refuse to Pay Attention to War Talk

Demand for domestic copper is active, and inquiry in the market at the present time is close to 10,000,000 lb. Most of this is from the wire companies, although a good proportion is from brass works. Domestic buying, however, is in moderate volume as consumers are still trying to find interests willing to sell under 14 cents.

Metal interests refuse to pay much attention to Near East war talk. A long touch with the Near East makes them realize that money accomplishes more in diplomatic circles in that area than probably any other place in the world. Therefore they expect an early settlement. Armies are more expensive to support than Near East diplomatists.

As was expected, the current week brought a further extension of the improvement in the iron and steel industry. With a lessening of the drawbacks arising from the coal mining and railroad labor troubles, production of pig iron and steel is recovering, and many of the blast furnaces that had suspended operations because of deficiency of fuel supply have started up once more.

The gain has been general, all districts making more favorable reports, and steel mills are now running, as a whole, at about a 65 per cent rate. An encouraging feature has appeared in the placing of important rail orders, and the leading interest, although recently announcing an advance of $3, effective Oct. 1, is at present booking contracts for the first half of 1923 at $40 per ton. While declines have occurred in certain grades of pig iron, the main price trend continues upward, and quotations in most instances are appreciably above the levels of a year ago.

NEW YORK METAL MARKET PRICES

| | Sept. 21, 1922 Cents per Pound | Sept. 28, 1922 Cents per Pound |
|---|---|---|
| **Copper** | | |
| Prime Lake | 14.00 | 14.00 |
| Electrolytic | 14.00 | 14.00 |
| Casting | 13.45 | 13.45 |
| Lead, Am. S. & R. price | 5.75 | 5.75 |
| Antimony | 5.25 | 5.25 |
| Nickel, ingot | 36.00 | 36.00 |
| Zinc, spot | 6.50 | 6.50 |
| Tin, Straits | 32.20 | 32.20 |
| Aluminum, 98 to 99 per cent | 19.10 | 19.10 |
| **OLD METALS** | | |
| Heavy copper and wire | 11.00–11.25 | 11.00–11.25 |
| Brass, heavy | 5.75– 6.25 | 5.75– 6.25 |
| Brass, light | 5.25– 5.50 | 5.25– 5.50 |
| Lead, heavy | 4.62½–4.75 | 4.62½–4.75 |
| Zinc, old scrap | 3.00– 3.37½ | 3.00– 3.37½ |

# Cuban Electrical Market Situation

### Present Conditions Have Good and Bad Features— People There Are Fast Spenders—Best Chances Are for Those with Native Connections

BY RUSSELL RAYMOND VOORHEES

WHAT are the chances of increasing the sale of American-made electrical goods in Cuba? The question can be easily answered by saying that the chances of increasing the sale of American-made electrical goods in Cuba are at this writing both good and bad. That seems strange, to say the least, but a little thought on the subject will show that such an answer comes nearer the truth than anything else could.

In the first place the sale of electrical goods or anything else in any country is dependent to a great extent on the amount of wealth that that country produces. To this can be added, of course, the wealth that the tourist leaves in the country. From this viewpoint Cuba is not a very good market for electrical goods at this time because her chief source of wealth, sugar, is more or less upset both as to price and as to demand. Her other big crop, tobacco, is showing an improvement, but at the same time it is not what it should be. An insight into the situation can be obtained from the fact that the men who cut the sugarcane in the field now get only 40 cents a day in comparison with $2 a day a year or so back. From this it can be seen that the wealth that Cuba is producing is not enough to make it a very good customer for electrical goods. Economic conditions in Cuba are still very much upset, although they are better today than they were a year ago or even six months ago. But at that conditions in Cuba are far from normal.

#### TOURIST MONEY IS HELPING

The tourist is visiting Cuba and spending money, to be sure, but no country the size of Cuba can develop itself on the tourist business alone. The money that the tourist is spending is helping the situation to some extent, but that is about all that can be said for it.

And so it is not hard to see why Cuba is not just now much of a market for American-made electrical goods; but while the present situation is not very encouraging as far as increased business is concerned, it is not hard to see a brighter future for increased sales there.

The population of Cuba is about 3,000,000. Outside of Havana and Santiago there are few if any cities that amount to a great deal. There are places with 25,000 to 50,000 population, but a Cuban city of even 50,000 population appears to be far smaller than an American city of the same size. It can truly be said that the mass of the Cuban population live outside of the two largest cities, and even outside of the smaller cities, and are of the peon class. For the most part they are poor. Their hotels or huts do not contain even the rudiments of comforts such as the poorer classes in the States know. These peons, who today because of poverty have practically no wants, can be made to be the great purchasing power of Cuba, and it is to them that I look when I say that the future possibilities for business in Cuba are good. The better class, of course, will have its wants, too, but no one has yet been able to deny that a large middle class able to buy is the best class of trade for any business to have.

One doesn't find electricity in the smaller towns and in the rural districts, but that will come in time. The reason it is not there now is that there is no need for it. But just as soon as the purchasing power of the average Cuban rises to a level where electric service is within his reach the question of electricity in the rural sections will be solved without much delay.

Cuba is bound to progress, and as she progresses she will become a better and better customer for American-made electrical goods. The peon will not be satisfied with his hovel and former life, and improvements will be the order of the day. It is hard to imagine a people improving their situation without making use of electricity. Some one will get this business when that time arrives. It might as well be the American manufacturer as anyone else. It is safe to say that this class of trade represents fully half of the total population of the island.

The other portion of the population, the more prosperous class, have homes that are wired for electricity and they know something of the advantages that come from its use in the home. But even among this class there are opportunities existing today to increase the sale of electrical goods. These people have the money with which to buy these things, and while they may not be buying just at the moment because of the unsettled economic conditions, they possess a potential buying power that is well worth paying heed to.

#### LIKES TO SPEND MONEY

The one thing that is a happy feature of the entire situation is that the Cuban is a spender. Money goes about as fast as it comes with him, regardless of how fast or slow it comes. He spends because he likes to spend, which is a good thing for business.

From this it can be seen that there are real opportunities in Cuba to increase the sale of American-made electrical goods. Among the better class it should be possible to sell almost any sort of electrical appliance right now, and in the future as conditions improve and as the condition of the peon becomes better and better it should be possible to interest him in electrical appliances to lighten the work in the

home and to make comforts more complete. It is just a question of waiting until Cuba produces wealth enough to put these things within reach of the mass of her population.

Right here it might not be amiss to say that the Cuban likes display, and since this is the case he should make an excellent customer for electrical appliances of various sorts, because they add a certain amount of display to any home.

It should be borne in mind that Cuba is in very close touch with Europe. A French steamship lines touches the island and German boats are beginning to come. All over Cuba it is possible to see goods which have been imported from Germany and France and the American manufacturer should remember this when he approaches the island for business. He will find some competition from these sources, but should not have much trouble in meeting it and even in beating it.

### CUBA FOR CUBANS

But in the selling of electrical goods or, in fact, anything in Cuba there is a trick. Cuba is a country that appears to be run for the benefit of Cubans. "Cuba for Cubans" appears to be their motto, and so American electrical goods manufacturers should take the hint and seek some connection that is Cuban. I have been told that unless a part of every business enterprise is Cuban it will not be allowed to exist, and while this statement is probably overdrawn, it does appear that a business enterprise that is not partly Cuban has a much harder road to travel than one that is partly Cuban. There seems to be little if any dislike for American goods; it is just a question of wanting a Cuban to be "in on the deal" and to "get his." It would be well while conditions are none too good to look into this phase of the situation and so to be ready with the proper organization when the Cuban is ready and able to buy.

Shipments to Cuba are a very easy matter. Goods can be loaded on freight cars at the factory in America and run to Key West, Fla., where the cars without unloading are run onto special boats that take them to Havana. At Havana they are run to their destination, making it possible to ship direct from the factory in America to the destination in Cuba without unloading. Railroad facilities in Cuba are most satisfactory and prompt service is given.

In conclusion, it is safe to say that American-made electrical goods can gain a wider market in Cuba, if not today, then tomorrow. The great mass of the population will some day seek some of the things that have heretofore been denied to them, and the wider use of electricity is then a certainty. This demand will be tremendous when it develops. Added to this is the possibility of increasing the sale of electrical merchandise to the better class now or in the very near future. Will American manufacturers share in the revival of business when it comes?

# The Week in Trade

**Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

DEMAND in the electrical market continues to grow better as fall and winter articles commence to sell in a more active way than for some years past, reports from all over the United States indicate. Central-station companies report increases in business.

Appliance sales are taking on renewed activity, flatirons and toasters leading. Heaters, owing to the coal strike, are selling in large quantities and stocks are reported sufficient for approximately two months' supply. Business in radio apparatus has shown much improvement during the last few weeks.

## New York

**Business Increasing—Residential Meters Selling Best—Small Motor Sales Spotty**

Business in the electrical industry continues to increase. Greater interest is being shown in sales of hollow ware, some jobbers reporting unusual demand for this time of the year for flatirons and toasters. An active business in heaters of all descriptions is on in earnest. Reports from central stations say that business is much heavier than a year ago. Conduit stocks are in much better condition.

**Meters.**—Residential types continue to sell best. A heavy demand is expected to continue for the rest of the year.

**Radio Equipment.**—Much improvement is reported. Sales during the last few weeks have been heavier than for some time past. Stocks are very heavy.

**Motors.**—Sales are spotty in the small-motor business and compared with the volume in 1921 are approximately 20 per cent better.

**Electric Heaters.**—Sales continue to increase and stocks are only fair.

## Chicago

**Entire Trade Is Moving Upward—Schedule Material Advances—Safety Switches Steady**

With the final settlement of both the railway and coal strikes, the electrical trade has started again on its upward swing toward better business. Jobbers are still troubled with slow shipments, but this situation is gradually righting itself.

Stocks of most material are in fair condition, with the sole exception of conduit, which is still at a premium. Building construction is still creating an active demand for wiring material. Schedule material, including push switches, advanced 10 per cent. High-tension manufacturers are continuing to be active. Inquiries on open-air heaters have started, and from present indications the winter's trade will be good.

**Conduit.**—Demand is still active, but stocks have improved but slightly. The ½-in. black pipe sells for $55 per 1,000 ft. in lots of 5,000 ft.

**Wire.**— Most all jobbers report good sales on rubber-covered wire. No. 14 is available in lots of 5,000 ft. for $6.30 per 1,000 ft. Stocks are normal. Call for bare and weatherproof wire has been steady. Prices are firm.

**Safety Switches.**—The call for the 30-amp. switch follows the activity of home building. Stocks are in good condition.

**Air Heaters.**—Dealers are reporting an increasing amount of inquiries relative to heaters. Stocks are in good condition, and jobbers feel that the winter business will be good.

**Fuses.**—There is a steady call for this material, which is absorbed mostly in the new building. Stocks are in good condition.

**Schedule Material.**—A 10 per cent increase on push switches, key and keyless sockets was announced during the week.

## Boston

**Loom Prices Show Tendency to Stiffen—Rigid-Conduit Delivery Situation Greatly Improved**

With the coal and rail strikes behind, business is hitting a faster stride. The demand for electrical material is unusually well distributed. Deliveries are better in smaller sizes of rigid conduit, but electric heaters are being offered on a four weeks' basis. Prices are firm and tend to stiffen in loom, weatherproof wire and steel products. General business in New England is improving, and little fear of industrial adversity resulting from a shortage in bituminous coal is expressed.

Jobbers' stocks are well maintained in most lines, but the demand for rubber-covered wire is so active that no great surplus is being accumulated. Building operations continue on a large scale, residential structures being in marked demand in suburban territory. Telephone and traction earnings are excellent and central-station outputs are increasing rapidly.

**Wire.**—Rubber-covered No. 14 was quoted Monday at $6.25 per 1,000 ft. in 5,000-ft. lots. Weatherproof base is about 17 cents. One large factory is now running three nights per week to catch up on rubber-covered orders.

**Loom.**—Prices show a tendency to stiffen. Deliveries are good and the demand moderate. In 1,000-ft. to 5,000-ft. lots, 7/32-in. loom sells at $16.75 per 1,000 ft. and ¼-in. at $19.50. Stocks are satisfactory.

**Tape.**—A fair demand is resulting from the increased amount of interior electrical construction lately observed. Prices vary widely according to quality, representative quotations on ½-in. black tape of excellent grade being 50 to 60 cents per pound in 100-lb. lots.

**Heaters.**—Jobbers' stocks have been cut to the quick and in some cases cleaned out by the sudden demand, notwithstanding the efforts of the factories to anticipate it. Vigorous retail sales efforts are reaping their reward.

**Rigid Conduit.**—Smaller sizes have have now come to hand in sufficient quantity to greatly improve the delivery situation, but larger sizes are still hard to obtain. Prices are steady, the 500-5,000-lb. lot quotation Monday on 1-in. black being $108.21 per 1,000 ft., galvanized being $118.41.

**Radio Apparatus.**—A rising demand is a feature of the market, although this has not yet equaled the volume of last year at this time. Jobbers anticipate an excellent fall and winter trade, however.

## Atlanta

**Jobbers Report Very Satisfactory Volume of Electric Heater Sales—Industrial Motors Slow**

"Georgia is on the road back to a healthy financial condition," according to the statement of F. R. Bennett of the State Department of Banking. His statement shows a reduction in loans and discounts of $35,391,000 over a year and a reduction in overdrafts of $133,674 over the same period. This will give a good picture of financial conditions throughout the state, with prospects for conditions to be bettered as soon as cotton crop now in the course of picking is marketed. The three largest railway shops in Atlanta have settled their difficulties with the striking shopmen and old employees returned to work on Sept. 20, thus settling practically the only labor difficulty in this city at the present time. Rail shipments continue very slow. Difficulty is experienced in obtaining fuel for industrial requirements and prices are high. Work on the eight-hundred-thousand-dollar viaduct in Atlanta was started this week, and the schools proposed under the recent bond issue amounting to $4,000,000 are also under way, assuring building activities in Atlanta for the next twenty-four months.

**Electric Ranges.**—Despite continued high prices, jobbers report a very satisfactory volume of sales, with local stocks in satisfactory shape. Shipments from factory are fairly good, but receipts are poor.

**Industrial Motors.**—The movement in this line continues slow, though there are good prospects for reawakened activity as soon as negotiations with a number of the larger textile mills are complete. Stocks are in good condition with factory shipments satisfactory and deliveries slow.

**Oil Switches.**—Only a fair volume of this specialty is being taken, most of the sales being for the outdoor type. This line will be likely to respond to the purchase by industrial plants within the next sixty days.

**Lighting Fixtures.**—A brisk movement in this line is reported by all dealers in both the residential and commercial types, the commercial leading the field at this time, and the prospects are for a continued demand for some time to come.

## St. Louis

**Conditions Better than Six Months Ago—Jobbers' Sales Holding Own—Wire Steady**

"Conditions in the St. Louis territory may be described as principally fair and better than six months ago," says a special report just issued by the Liberty Central Trust Company, based on a questionnaire sent to 250 banks in southern Illinois, Missouri, Arkansas, Oklahoma and Texas. "The farmer's financial prospects are not yet entirely satisfactory. Opinion is divided evenly on the question of profit. In Arkansas and Texas most correspondents believe that the farmer will do better than break even. To a less degree this is true in Missouri, and in Oklahoma and Illinois the majority assert that in 1922 the farmer will get but meager returns." The oil business is reported fair, building generally active, live-stock industry fair to good, and retail trade fair.

Local jobbers report that trade is holding its own but not showing the continued increase anticipated. The recent strikes created an unfavorable mental attitude, but one prominent jobber states that business confidence is bettering, and he anticipates more activity this fall. The higher prices are expecteed to be of aid to the jobbers, and with the higher resulting profits they hope to offset the losses preceding June so as to break even on the year's business. Larger stocks are maintained as the general level of electrical prices rises.

**Loom.**—Good stocks are on hand to meet an active demand, and prices are increasing. The principal demand is for new residential construction, and some decreases may be expected later this year. The price of 7/32-in. is $15.75 per 1,000 ft. and ¼-in. is $18.40, both in 1,000-ft. lots.

**Wire.**—Sales continue in the same relative volume. Stocks of rubber-covered, with the exception of No. 14, are low. Prices are tending upward. No. 14 rubber-covered sells for about $6.50 per 1,000-ft. in 5,000-ft. lots, while weatherproof in sizes from No. 4/0 to No. 8 inclusive have increased from $17 to $17.50 and $18 per 100 lb. in lots of 500 lb. and larger.

## Cleveland

**Radio Sales Surpass All Expectations—Heaters Are Active—Refrigerating Machine Sales Decline**

With the advent of fall comes renewed activity in the sale of appliances. Small portable heaters are moving well and a brisk season is predicted. Several dealers are operating booths at the "Palace of Progress" exposition and have stimulated interest in washers and cleaners.

**Radio Equipment.**—Sales of the past week have surpassed all expectations as it was not generally expected that the fall season would commence so early. Demand, however, while heavier than usual, does not absorb the supply, since production has been increased to permit a reserve stock with which to handle the "hold" orders.

**Heaters.**—The cold snap has been considered responsible for the sudden demand for the small portable type. Dealers are well stocked but are replenishing the supply to meet an expected increase in demand which they believe will be caused by the fuel shortage this winter.

**Washers.**—Although a few dealers report normal consumption, sales in the aggregate have decreased and have seemingly affected ironers, which have also shown a decline.

**Refrigerating Machines.**—The diversion of the attention of consumers to heating devices has caused a sharp decline in refrigerating sales. Jobbers are preparing estimates, however, for contractors engaged in apartment-house construction.

**Motors.**—As if in compensation for the stagnation of other products, jobbers report a fair activity in motor sales although confined to the smaller type. Supply and deliveries of stocks are fair.

**Lamps.**—An increase of more than 25 per cent in lamp sales is reported. The supply is sufficient, however, to meet the demand and leave a satisfactory margin.

## Salt Lake City

**Collections Show Steady Improvement—Lamp-Cord Stocks in Excellent Shape — Wire Steady**

That manufacturers and financial concerns are operating on a better profit basis is indicated in current dividend reports. Many firms that suspended dividends during the worst period of depression have lately resumed payments. A speculative tendency in investments has reduced many excellent local bond and stock offerings to a condition of minimum demand. Collections show a quite steady improvement.

Weather conditions are ideal for harvesting. There has been no let-up in building activity. Rough labor is in good demand, while there is a considerable oversupply of clerical help.

Salt Lake City will be the Mecca of

electrical men for two weeks, beginning Oct. 2. The big electrical exposition, held under the auspices of the Rocky Mountain Electrical Co-operative League will, it is said, present a million-dollar display of electrical products, with factories in every part of the country amply represented.

**Lamp Cord.**—Jobbers' stocks are in excellent shape. Prices have advanced.

**Wire.**—In steady demand, though not ordered in large quantities. Mine activity is creating a better market. Prices show a stiffening tendency.

**Rigid Conduit.**—Slight price increases in the past month. Demand is good.

## Portland-Seattle

**Improvement in Business Seen — Demand for Washers Active — Fan Stocks Well Cleaned Up**

Water-borne commerce of the ports of the Northwest is very encouraging, and present indications are that the total volume for the year 1922 will far exceed any other year's business. The lumber cut is above normal at the present time, and the demands are so great that practically every mill is making an endeavor to cut as much as possible in the few weeks remaining before winter conditions interfere with logging operations. Bank deposits also show a very material increase over a year ago. This section of the country is faced with a serious shortage of cement, which is seriously interfering with construction work at the present time. Grain shipments continue to increase. Electrical jobbers report business to be exceptionally good. Almost all lines of material are in demand, but particularly along the line of construction material. Manufacturers report much the same condition, stating that while business will not equal some past records, it is very good and far better than it was during the first quarter of this year. Central stations and the lumber industry seem to be creating the principal demands. The railroads were buying actively before the strike, but since that time orders have been somewhat curtailed. General reports indicate that the strike is not seriously affecting transportation in this section as transcontinental shipments have been coming through in very good time. Jobbers report that local railway transportation conditions are improving. Prices usually are very stable and stocks are in good shape, some few lines being a little short. Central-station generation for the past week is reported to be the greatest in the history of Portland and exceeds that of a year ago by approximately 20 per cent.

**Washers.**—The demand for washers and ranges is very active throughout the Northwest.

**Appliances.**—There is a strong demand for practically all lines of household appliances. Fan stocks have been very well cleaned up. The demand for room heaters is increasing rapidly.

## San Francisco

**Heating Devices in Brisk Demand—Steady Demand for Private Telephones—Wire Improving**

Building construction continues at a fast pace, employing every available man. Easier credit conditions, particularly in the inland districts where the bulk of the crops are now being marketed, and the practical elimination of non-employment, providing better retail markets, will reflect themselves in better business through all successive sources of distribution. The increasing industrial importance of San Francisco and the Bay region is emphasized and augmented by the location of a new General Electric Company factory near Elmhurst, the first unit of a large plant, and by surveys made by active new-business departments of power companies which have now an increasing power surplus.

**Ranges.**—Electric ranges are moving well, especially in Alameda and Contra Costa Counties. One large power company is apparently specializing on apartment houses and on one make, though not exclusively. Another company is purchasing four or five makes in carload lots and making fairly rapid turnovers.

**Household Appliances.**—Country fairs and fall industrial shows are being well covered and are now recognized battle grounds for publicity. Slightly revised models are causing a slight upward trend of prices with fairly staple trade prices to provide greater profits for dealers. Electrical homes are being revived in the Bay region, their original starting point.

**Telephones.**—There is steady though rather negligible demand for rural telephones on private lines. Interphones, however, are selling well. One firm reporting an average of one apartment house per day since early in the year. Such apartments average eight to ten sets and total about $500 per job.

**Special Wires.**—Special rubber cables for a variety of industrial purposes are proving a fruitful field.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

### Anaconda Company Asked to Give Bid on Largest Inquiry

The largest copper-wire inquiry ever received in this country came from Japan last week, according to an official of the Anaconda Copper Company.

"We received an inquiry from Japan," the official said, "for 2,500,000 lb. of copper strand for the Tokio Electric Company. This is the largest foreign inquiry for copper wire ever received in this country. The contract has not yet been awarded, but it is unlikely that an American firm will obtain the order because Japanese buyers must pay a 30 per cent ad valorem import duty on copper."

Approximately 12,000 miners, smelter men and other employees of copper mining companies in Montana have received an increase of 50 cents a day in wages, according to the official quoted. Miners will receive $4.75 a day.

### Kerr Turbine Company Holds Sales Convention

The annual sales convention of the Kerr Turbine Company, manufacturer of steam turbines and gears, was held at the plant, Wellsville, N. Y., on Sept. 11 to 13. Business sessions were interspersed with pleasure trips through the adjoining country and also with entertainment at the Sagamore Camp of Paul B. Hanks, president of the company.

General renewed activity in business was reported from all sections, from the Atlantic to the Pacific Coast and from Texas to Canada. An inspection of the plant was also made, particular interest being shown in the test department.

### Ohio Brass Ships Twenty-five Cars of Porcelain Insulators

The large amount of new transmission-line construction being undertaken in the Northwest this year is indicated by the fact that one insulator manufacturer, the Ohio Brass Company, has already shipped into that district a total of twenty-five cars of porcelain insulators of all types, principally high-tension pin and suspension units.

### Brown Instrument Company Opens Two New Sales Offices

The Brown Instrument Company, Philadelphia, announces the opening of its New England branch sales office at 185 Devonshire Street, Boston. George Goodman is in charge. The company also announces the opening of its Southern district branch sales office in the Brown-Marx Building, Birmingham, Ala., in charge of Charles L. Saunders.

### Rome Wire Company Opens Boston Sales Office

The Rome Wire Company, with plants in Rome, N. Y., and Buffalo, N. Y., has recently opened a Boston sales office in the Little Building, Boston. This office will be in charge of C. G. Miller, who has previously represented the company in the territory mentioned.

## Westinghouse Receives Large Order for Power Equipment

The large increase in the demand for electric light and power in the territory surrounding Pittsburgh has made necessary additions in equipment by the West Penn Power Company. Several large orders have been placed recently, the latest, amounting to approximately $400,000, being for transmission apparatus, to be supplied by the Westinghouse Electric & Manufacturing Company.

This order includes nineteen transformers and fifty-three oil circuit breakers. The transformers are all oil-immersed, self-cooled, single-phase, 60-cycle outdoor type. Of these, four are rated at 10,000 kva., 132,000/25,000 volts; seven at 2,000 kva., 25,000/7,500-2,500 volts; four at 5,000 kva., 132,000/-25,000 volts, and four at 500 kva., 25,000/7,500-2,500 volts.

The oil circuit breakers are for outdoor use and are three-phase, electrically operated. Three are type G-2, 132,000 volts, 400 amp.; two are type 0-21, 25,000 volts, 1,200 amp., and forty-eight are type 0-21, 25,000 volts, 600 amp.

## Dealers Complain of Narrow Margins of Profits

Members of the Pennsylvania State Association of Electrical Contractors and Dealers have notified the Electrical Supply Jobbers' Association that the present differential is not great enough to enable the contractors and dealers to make a reasonable profit. The association also went on record to work for legislation that will require the licensing of contractors.

In the discussion of profits on appliances speakers said some houses at present are selling at a profit of 5 per cent, or at a price less than the general run of dealers can purchase the goods. The speakers made it plain that it was not their desire to attempt to curb price cutting, but they were of the opinion that the manufacturers' price lists should be high enough so that with a substantial discount the dealers could make a reasonable profit on a sale.

## Company to Make Radio Parts Is Organized in Connecticut

The Cheshire Manufacturing Company, West Cheshire, Conn., has been organized and will take over a plant in West Cheshire, adjoining the Connecticut Brass Works, to manufacture various electrical novelties, radio parts and devices. The concern is headed by F. Cranston Thomas, president of the Natural Dyewoods, Inc., and George A. E. Jones of the United States Electrical Company, New London, Conn.

The new company has received an order from a large radio corporation for 1,000,000 pocket radio boxes and for 40,000 cabinets, similar to those used for phonographs, in which the radio company will install receiving sets that make unnecessary the use of outdoor or indoor antennas.

About $50,000 will be expended in improvements and several hundred workers will be employed.

## Mack Batteries in Northwest Selling Actively

A branch factory is now being established in Portland, Ore., by the Mack Battery Company of Los Angeles, Cal. LaFaver & Jordan, distributors of the Mack dry battery in that city, announce that sales are climbing rapidly, 1,500 batteries of all sizes having been sold in Oregon and Washington during the first ten weeks of operation. The new plant will reduce freight rates and insure better deliveries.

**The Tiffany Electric Company,** 131 Howell Street, Jersey City, N. J., manufacturer of electrical specialties, has filed plans for the erection of a one-story building at its plant.

**The Indiana Battery Service Company,** 1,007 North Meridian Street, Indianapolis, has acquired property at 1,136 North Meridian Street, 80 ft. x 320 ft., as a site for the erection of a new one-story plant, plans for which are now being prepared.

**General Electric Company** business at its Schenectady plant continues upward, officials of that company state. Though the company has given out no figures lately regarding the number on the payroll, the total is believed to be within approximately 3,000 of the normal figure, around 18,000 persons.

**The Post-Glover Company,** Cincinnati, manufacturer of panelboards, switchboards and accessories, celebrated its thirtieth anniversary on Sept. 12.

**The Hoover Suction Sweeper Company, North Canton, Ohio,** is issuing pictures of Christmas electric cleaner displays in preparation for holiday business.

**The Power Specialty Company,** 111 Broadway, New York City, announces the appointment of Pell W. Foster, Jr., as New England district sales manager, with offices at 50 Congress Street, Boston. Mr. Foster was formerly in the New York sales office.

**The Henderson Electric Company,** North Adams, Mass., is planning to move to larger quarters in the Richmond Hotel Annex.

**The U. S. Electro Galvanizing Company,** with main office and factory at 32 Brockton Street, Brooklyn, N. Y., announces its change of name to the U. S. Galvanizing & Plating Equipment Corporation.

**The Coleman Electric Company,** Allentown, Pa., has opened an electrical department in the Bush & Bull Department Store, Bethlehem, Pa., with a full line of Gainaday washers and appliances.

**The Standard Variometer Company,** City Point, Va., recently organized, has arranged for the operation of a plant in that city for the manufacture of radio equipment and parts and kindred electrical specialties.

**The Electrical Appliance Manufacturing Company,** Waterbury, Conn., has filed a certificate with the Secretary of State of Connecticut increasing its capital stock from $10,000 to $100,000. The issue will be used to increase production.

**The Walker Vehicle Company,** electric trucks, Chicago, announces that it expects to open a Buffalo branch sales office in the near future. According to C. A. Street, sales manager, the company has been operating its large new factory full time for many months and is now planning to operate a night force owing to increasing sales.

**The Burdick Cabinet Company,** Milton, Wis., manufacturer of cabinets, radio cases, talking-machine panels, etc., has engaged the Federal Engineering Company, Milwaukee, to design a brick and steel manufacturing addition, 80 ft. x 160 ft., two stories and basement, estimated to cost $50,000.

**The Wabash Electric Company,** Clinton, Ind., has plans under consideration for extensions and improvements in its plant and system to cost approximately $50,000.

**The Electric Storage Battery Company,** Philadelphia, has obtained a permit for construction of a factory building and assembly plant at Rochester, N. Y., to cost approximately $60,000.

**The Northeast Electric Company,** Rochester, N. Y., manufacturer of electrical equipment, announces that it will erect a two-story addition to its plant, 50 ft. x 90 ft., to cost $35,000.

**The Standard Electric Works,** Montgomery, Ala., recently organized, has arranged for the establishment of a plant at 17 Bibb Street for the rebuilding and repair of electric motors and other electrical equipment.

**The Universal Burner Company,** manufacturer of liquid-fuel burning equipment, Logansport, Ind., recently incorporated under the laws of Indiana at $25,000, all common stock, expects to build all its equipment with the exception of large air compressors and steam pumps, which it will purchase on the market. It will also purchase motors for use in connection with small units and motor-driven oil pumps.

**The Atkinson Armature Works,** Pittsburgh, Kan., announce that they have awarded a contract to the Helman Rogers Construction Company, Pittsburgh, for the erection of a one-story basement addition to their electrical equipment plant.

**Ophuls, Hill & McCreery, Inc.,** consulting engineers, 112 West Forty-second Street, New York City, announce that the firm name has been changed to Ophuls & Hill, Inc. The firm has issued a bulletin describing its five years in business. Officials state that $10,000,000 worth of work has been built under the supervision of the company during that time.

**The Alp Manufacturing Company,** Newark, N. J., announces that it has changed its name to the Continental Electric Company, Inc.

## Foreign Trade Notes

CONCESSION GRANTED FOR ELECTRIC RAILWAY IN LIMA, PERU.—The Peruvian government, according to Assistant Trade Commissioner Turner, Lima, has authorized the presentation of plans for the construction of an electric railway. The new line will start at the Avenida Industria, Lima, and will connect with the present system at either Bellavista or Callao. A concession has already been granted for the construction of an electric car line from Lima to La Punta via Magdelena.

SECOND POWER STATION PROPOSED FOR LAKE COLERIDGE, NEW ZEALAND.—Plans have been completed, according to the *Electrician*, for a second power station at Lake Coleridge. A complete duplication of the present headworks, including intake and tunnel, are included in the supplementary scheme. The present station has a generating capacity of 12,000 kw. Representations are to be made to the government to proceed with the work with as little delay as possible.

EXTENSION TO ELECTRIC POWER AND TRAMWAY SYSTEM IN SAO LUIZ DO MARANHAO, BRAZIL.—Proposals are solicited until Nov. 27, the *Electrician* reports, in connection with the scheme of the municipality to grant a concession for a period of thirty years for the extension of an electric light, power and traction system. The town has a population of about 53,000.

PROPOSED EXTENSIONS TO TELEPHONE AND TELEGRAPH SYSTEMS IN AUSTRALIA. — The Australian House of Representatives on Aug. 31, according to the *Electrician*, passed a bill authorizing the raising of a loan for £17,000,000, of which £3,000,000 will be used for postal, telephone and telegraph extensions.

PROPOSED ELECTRICAL DEVELOPMENT FOR POLAND.—A scheme of works which are considered to be of an urgent nature is reported to have been prepared by the Union of Polish Electrical Undertakings, according to the *Electrical Review*. Among other things, the project, which it is hoped to carry out with the aid of foreign capitalists, provides for the construction of a central power station at Boryslaw, together with electric railways in this oil region.

## Foreign Trade Opportunities

ELECTRIC LIGHTING SYSTEM PROPOSED FOR BANKSTOWN, AUSTRALIA. —The Town Council of Bankstown, New South Wales, Australia, the *Electrican* states, has approved a plan to borrow £30,000 for the installation of an electric lighting system.

THE ADELAIDE ELECTRIC SUPPLY COMPANY, Grenfell Street, Adelaide, Australia, according to the *Electrician*, will receive tenders until Dec. 5 for 300 electric motors.

MUNICIPAL ELECTRIC SYSTEM PROPOSED FOR BATHURST, AUSTRALIA.—The City Council of Bathurst, New South Wales, Australia, the *Electrician* reports, has decided to appropriate £40,000 for the installation of an electric system for the city.

THE VICTORIAN ELECTRICITY COMMISSION, 22 William Street, Melbourne, Australia, the *Electrican* states, will receive tenders until Jan. 23, 1923, for a back-pressure steam turbo-generator set, including a 1,500-kw. alternator.

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Catalogs and full information are desired in the Philippines (No. 3,580) regarding radio apparatus.

Equipment is desired for a radio transmitting station, rated at 1 kw. in the antennas and with cathode lamps, in Czechoslovakia (No. 3,603). Quotations are also desired on 0.5 kw. or 0.25 kw. in the antennas.

Telephone cables and equipment are desired in connection with remodeling a central station in Bulgaria (No. 3,631).

A party in Canada (No. 3,635) desires to purchase electric floor scrapers.

An agency is desired in New Zealand (No. 3,641) for high-voltage insulators (110,000 volts).

Electrical goods, machinery, boiler fittings, etc., are desired in India (No. 3,644).

Information is desired on electric plants, machinery, tractors, hardware, etc., which may be required by the government or general merchants in South Africa (No. 3,673).

An agency is desired in Italy (No. 3,690) for electrical apparatus, electric clocks, fire gages, etc.; purchase desired.

Information is desired in Czechoslovakia (No. 3,692) on electric vacuum cleaners, carpet sweepers, etc.

A party in Spain (No. 3,703) desires to purchase electric ventilators, storage batteries, lanterns, etc.

Representation is desired by an importing firm in Egypt (No. 3,709) of manufacturers of telephone equipment, electric generators, internal-combustion power plants, low-pressure waterwheels, electric lighting equipment, etc.

## New Apparatus and Publications

FIXTURES.—An accessory line of "Red Spot" hangers and brackets for commercial lighting has been announced by the F. W. Wakefield Brass Company, Vermilion, Ohio. These units supplement the regular "Red Spot" line and are intended for lighting of hallways, rest rooms, closets, etc. They include a ceiling-type fixture, one of the suspension type and one pendant, all of the same standard construction as regular "Red Spot" hangers.

HOME LIGHTING. — Julius Andrae & Sons, Milwaukee, have issued a pocket catalog of home lighting to the retail trade.

BEARING METALS.—The A. W. Cadman Manufacturing Company, Pittsburgh, has issued Engineering Bulletin M-2, giving information on bearings and bearing metals.

ELECTRICAL COMMUNICATION.—The Western Electric Company, New York City, is issuing for the first time a magazine published by the International Western Electric Company and intended for distribution in foreign lands. The purpose of this publication is to give a clearer picture of electrical communication to foreign government officials interested in telephone and telegraph work and to others.

CABLE SPANS. — The English Electric Company, Ltd., London, England, has issued publication 368, describing cable spans.

VARIABLE-SPEED TRANSMISSIONS. —The Fairbanks Company, New York City, has recently issued bulletins describing the ball-bearing, self-oiling and standard designs of variable-speed transmissions.

CABLE END BELLS. — The Electrical Engineers' Equipment Company, Chicago, has issued publication bulletin 110, covering cable end bells.

ELECTRIC VEHICLES. — The Walker Vehicle Company, Chicago, has issued a folder describing the Walker "Pay-out-of-the-Savings" plan in the purchase of electric trucks.

DRIERS.—The B. F. Sturtevant Company, Hyde Park, Boston, has issued bulletin 299 on unit driers. This drier consists of a motor-driven fan, the air from which passes over heater coils and then is discharged into a cabinet.

MOTORS.—Bulletin No. 29, issued by the Century Electric Company, St. Louis, describes its type R. S. single-phase motor.

REFLECTORS. — The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, is distributing circulars describing its new X-ray Curtis adapter, No. 3,000, and its new convex luminaire, No. 5,000. The Curtis adapter converts an ordinary floor lamp into an indirect-lighting fixture.

## New Incorporations

THE HOME MUTUAL LIGHT COMPANY, Harrisonburg, Va., has been incorporated with a capital stock of $10,000. Dr. Ashby Turner is president.

THE CAP ROCK LIGHT & POWER COMPANY, Crosbyton, Tex., has been organized by S. A. Guy, J. C. Orr and E. H. Wheat. The company is capitalized at $40,000 and proposes to construct and operate an electric lighting plant in Crosbyton.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

NORWAY, ME. — The Central Maine Power Company, Augusta, is planning to install additional machinery at its local plant, including waterwheel, generator and auxiliary power equipment.

INDIAN ORCHARD, MASS.—The Indian Orchard Company will soon begin work on a one-story power house at its cotton mill, to cost about $80,000.

SPRINGFIELD, MASS. — The Indian Orchard Company has awarded a contract for the erection of a boiler house at its plant, to cost about $75,000.

WAVERLY, MASS. — Plans have been completed for the erection of a one-story power house, 75 ft. x 78 ft., at the School for Feeble-Minded.

## Middle Atlantic States

NEW YORK, N. Y.—The Fleishman Company, 701 Washington Street, will install an electric substation at its yeast plant on 158th Street, to cost about $20,000.

TONAWANDA, N. Y.—The Town Council has awarded a contract to the Tonawanda Power Company for the installation of a special lighting system on several streets, comprising 100 lighting units.

VISCHER FERRY, N. Y.—The Department of Public Works, Albany, has completed plans for the construction of a hydro-electric power plant on the State Barge Canal at Vischer Ferry. Bids will be called at once.

KEARNY, N. J.—The Ford Motor Company, Lincoln Highway, will build a power house at its local assembling plant, to cost about $100,000.

STOCKTON, N. J.—The Eureka Power Company, Trenton, has applied to the Delaware Township Committee for permission to erect transmission lines from Stockton to Rosemont and Sergeantsville and on various other roads in the township.

TRENTON, N. J.—The city has authorized the Public Service Company to install additional lamps on South Warren Street.

HARRISBURG, PA. — An underground police and fire-alarm system will be installed in the Reservoir Park section.

JERSEY SHORE, PA.—The New York Central Railroad Company, New York, plans to double the capacity of the power house at its local shops. The cost is estimated at $100,000.

PHILADELPHIA, PA.—The Kensington Hygeia Ice Company, Trenton Avenue, will build a one-story addition to its power house.

PHILADELPHIA, PA. — Power equipment, ovens, conveying machinery and other mechanical equipment will be installed in a baking plant for the Great Atlantic & Pacific Tea Company, Philadelphia, to cost about $80,000, for which a general contract has been awarded to the Turner Construction Company. Headquarters of the company are at 150 Bay Street, Jersey City, N. J.

WILLIAMSPORT, PA. — An ornamental lighting system will be installed on West Fourth Street, from Pine to Hepburn Street.

WOMELSDORF, PA.—Merger plans are being perfected between the Womelsdorf Electric Company and the Berkshire Electric Company, under the latter name. The Womelsdorf company has acquired the local system.

SEAFORD, DEL.—The Kent County Electric Light Company has been acquired by the Eastern Shore Electric Light Company. The new owner will make extensions and improvements in the local system.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company will build a three-story plant at 501-31 Madison Street, to cost about $113,000.

BRUNSWICK, MD.—The Potomac Public Service Company has contracted with the Baltimore & Ohio Railroad Company for power supply for its local shops.

CAMBRIDGE, MD.—Plans are being arranged for the installation of an ornamental

lighting system in the business district. The Chamber of Commerce is interested.

BLACKSBURG, VA.—The Virginia Polytechnic Institute has plans under way for the construction of a power house to cost about $50,000. Wiley & Wiley, People's Bank Building, Lynchburg, Va., are engineers.

SUFFOLK, VA.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in the business district.

WASHINGTON, D. C.—The Corby Baking Company, Georgia Avenue, N. W., will build a one-story power plant addition in connection with extensions at its local plant.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Oct. 12, for mechanical and electrical equipment for Canal Zone service, including fans, motor, cable, wire, ammeter, voltmeter, flexible non-metallic conduit, steel conduit, automatic arc controls, vacuum tubes and miscellaneous electrical supplies. (Circular 1496.)

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, Munitions Building, Oct. 4, for equipment for the complete assembly of 250 Simplex telegraph sets. (Circular PR 9385-1CP.)

## North Central States

DETROIT, MICH.—The Ternstedt Manufacturing Company, Muster Street, will build a power house at its factory, to cost about $25,000.

DETROIT, MICH.—The Board of Works will build a power house on Byron Street, to cost about $50,000. Albert Kahn, Marquette Building, is architect.

KALAMAZOO, MICH.—The Bryant Paper Company will build a one-story power plant at its mill.

SAGINAW, MICH. — The Baker-Perkins Manufacturing Company will soon begin work on construction of a one-story addition to the power plant at its local factory.

LARUE, OHIO. — Sufficient funds have been subscribed by local citizens for the construction of a new municipal electric plant. Work will be started in the near future on the new system. The village has been without electrical service for several months.

HAMMOND, IND. — The Commonwealth Edison Company, Chicago, contemplates the construction of a power plant in Hammond, to cost about $100,000.

MICHIGAN CITY, IND.—The Pullman Company, Chicago, will build a power plant in connection with a new local foundry, to cost about $500,000.

PENDLETON, IND.—Bids will be received by the Board of Trustees, New Indiana Reformatory, until Oct. 4 for equipment for the power house at the local institution, including generator, exciter, boilers, pumps, etc. Charles W. Mouch is president.

SOUTH BEND, IND. — The Studebaker Corporation will soon begin work on an addition to the power plant at its local automobile works, to cost about $125,000.

TERRE HAUTE, IND. — The American Hominy Company is said to be planning to rebuild its local factory and power plant, recently destroyed by fire, causing a loss of about $3,000,000.

CHICAGO, ILL. — The Commonwealth Edison Company has prepared plans for an addition to its substation at Fifty-sixth and Lowe Streets, to cost about $20,000.

MARSHALL, ILL.—The City Council will receive bids until Oct. 5 for the construction of a new municipal power plant, with ice-making and refrigerating plant extension, to include two generators, Corliss engines, two water-tube boilers, feed-water heater, feed pumps, piping, etc.; also ice-manufacturing machinery for an initial capacity of 15 tons per day.

CAMPBELLSPORT, WIS. — The Badger Public Service Company has been granted permission to erect an electric transmission line along the State Trunk Highway to the village of Campbellsport.

EAU CLAIRE, WIS.—Construction has started on the $150,000 hydro-electric power unit for the Dells Paper & Pulp Company. The work is being done by C. R. Meyers & Sons, Oshkosh, and when complete will give the paper company 3,000 additional horsepower.

LA CROSSE, WIS.—Local business men have raised $2,200 for an ornamental lighting system on Caledonia and Clinton Streets. Efforts are being made to raise an additional $800 to extend the system another block.

GREEN BAY, WIS.—The Wisconsin Public Service Company is to begin the construction of a power line from Pound to Marinette and Menominee, a distance of 22 miles, at an estimated cost of $105,000. The new line will tie the High Falls property to the Marinette property of the company in such a way as to make it possible to use High Falls power in Marinette, or, if necessary, to send Marinette power to Green Bay. Surveys for the work have been completed. The work is now in charge of Charles M. Hasseler of Green Bay.

MADISON, WIS.—Applications have been filed by the Northern States Power Company with the State Railroad Company for permission to construct three power projects to supply electricity in St. Paul, Minneapolis and other Northwestern cities.

MOSINEE, WIS.—Work has begun on the cofferdam for the new spill gate and power house for the Wausau Sulphate Fibre Company. A new power house will be erected near the present building and the old wooden spill gates will be replaced.

OSHKOSH, WIS.—A 500-kw. rotary converter has been installed at the Oshkosh railway substation of the Eastern Wisconsin Electric Company. The work of rebuilding the Oshkosh car shops and barns destroyed by fire last spring is under way. The new building will house the machine shop, blacksmith shop, carpenter shop and armature department.

CEDAR RAPIDS, IOWA. — The Iowa Railway & Light Company has prepared plans for the construction of a two-story meter house on Dewey Avenue, 25 ft. x 60 ft.

MAQUOKETA, IOWA.—The Iowa Electric Company, it is reported, will soon call for bids for the construction of a 200-hp. hydro-electric power plant, to cost about $175,000. Holland, Ackerman & Holland, 53 West Jackson Boulevard, Chicago, are engineers.

MARSHALLTOWN, IOWA.—Bids have been rejected for the proposed electric substation and transmission line to be constructed in connection with a new electrically operated pumping plant at the municipal waterworks. New bids will be asked at an early date. Burdick & Howson, 8 South Dearborn Street, Chicago, are engineers.

KANSAS CITY, MO.—The Kansas City Southern Railroad Company has preliminary plans in progress for the erection of new locomotive and car shops at Pittsburg, Kan., including steel car shop, engine shop, power house, etc., to cost about $1,000,000, including machinery.

RICH HILL, MO.—The Common Council has approved a bond issue of $20,000, the proceeds to be used for the purchase of new equipment for the municipal electric power plant.

ST. LOUIS, MO.—The United Railways Company has plans under way for the construction of a new power house and a number of one-story substations in different parts of the city.

HASTINGS, NEB. — Contract has been awarded to the Gedney Construction Company, Hastings, for extensions and improvements to the municipal power plant, to cost about $20,000.

CALDWELL, KAN. — Plans are being prepared for extensions and improvements to the municipal electric plant, including the installation of new equipment. H. G. Olmsted & Company, Oklahoma Building, Oklahoma City, are engineers.

WICHITA, KAN. — The Kansas Gas & Electric Company has arranged for an issue of $3,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

## Southern States

BELHAVEN, N. C.—Bonds to the amount of $30,000 have been issued for the installation of a municipal electric plant.

GREENSBORO, N. C.—Plans have been completed for the extension of the ornamental street-lighting system on East Market Street.

ROBBINSVILLE, N. C.—The construction of a municipal electric light plant in Robbinsville is under consideration. It is proposed to build a dam and hydro-electric plant on Wiggins Creek, near Robbinsville.

WILSON, N. C.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on several streets in the city.

FLORENCE, S. C.—The Palmetto Power & Light Company is reported to have purchased the municipal electric plants in Dillon, S. C., Latta, S. C., and Rowland, N. C. The company is planning to erect a transmission line from Maxton, N. C., to Marion, S. C. (40 miles long) to supply electricity to the above towns.

ATLANTA, GA.—The Georgia Railway & Power Company is planning to build a transmission line from Rome to Chattanooga, Tenn., about 100 miles, to connect with the system of the Tennessee Power Company.

MARIANNA, FLA.—The Hardaway Construction Company is planning for the construction of a new hydro-electric plant on the Chipola River, to cost about $100,000.

CHATTANOOGA, TENN. — The Signal Mountain Mining Company is planning for the development of extensive coal properties in the Suck Creek field, and will install electrical and other equipment. The cost is estimated at $200,000.

KNOXVILLE, TENN. — The Knoxville Power & Light Company has increased its capital stock from $2,050,000 to $10,000,000, part of the proceeds to be used for extensions and improvements.

LAWRENCEBURG, TENN.—Plans are under consideration to double the capacity of the municipal electric plant.

NASHVILLE, TENN.—The Douglas Coal Mining Company, 504 First National Bank Building, recently organized, is planning for the edevelopment of properties in the vicinity of Island, Ky., to include the installation of electrical machinery and other apparatus.

PARKVILLE, TENN. — The Tennessee Power Company, Chattanooga, has been granted permission by the State Public Utility Commission to issue $250,000 in bonds, the proceeds to be used for extensions and improvements.

TUSCALOOSA, ALA.—The Van de Graff Coal Company, recently organized, has acquired the properties of the Brookwood Coal Company and plans to increase production. New electrical equipment will be installed.

CROSSETT, ARK.—The Crossett Lumber Company will build a one-story power plant at its mills, to cost about $75,000.

NEW ORLEANS, LA. — The Citizens' Light & Power Company has plans under way for the construction of an addition to its electric generating plant to cost about $200,000, including machinery.

HUGO, OKLA.—The Hugo Light & Power Company has applied to the County Commissioners for permission to erect a transmission line from its local plant to Boswell and Soper, to supply electricity in those towns. Franchises have been granted to the company in both places.

PONCA CITY, OKLA. — The Marland Refining Company is completing plans for extensions in its local oil refinery. A number of new plant units will be constructed. A new water-works system, with electrically operated pumping machinery, will be installed. The entire project is estimated to cost about $1,500,000.

HOUSTON, TEX.—The installation of an ornamental lighting system on Washington Avenue is under consideration.

DALLAS, TEX.—The Dallas Investment Company will install an electric lighting and street-lighting system on a tract of property recently acquired in the vicinity of Preston Road and University Boulevard, to be developed for residential service.

## Pacific and Mountain States

CHEHALIS, WASH.—The Council has approved plans for the installation of an ornamental lighting system on Pacific Avenue from Park to Front Streets.

POMEROY, WASH.—The Pacific Power & Light Company has been granted a franchise to erect a transmission line from Pomeroy to Pataha.

SPOKANE, WASH. — The Washington Water Power Company contemplates the erection of a transmission line on the Inland Empire Highway from the city boundary line north.

STANWOOD, WASH.—The Washington Coast Utilities Company will erect a transmission line from Arlington to Stanwood and will make improvements in the local system.

STEVENSON, WASH.—Work will soon begin on the erection of a power house on Herman Creek above Cascade Locks for the Skamania Light & Power Company. The company has recently increased its capital stock from $20,000 to $50,000.

ASTORIA, ORE.—The Hammond Lumber Company will construct a one-story power plant in connection with the rebuilding of its mill, recently destroyed by fire, causing a loss of about $750,000.

PORTLAND, ORE.—F. K. Masters, Lewis Building, and associates, have applied to the State Water Department for permission to construct a hydro-electric plant on the McKenzie River, in Lynn County.

PORTLAND, ORE.—George L. Cleaver, 524 Railway Exchange Building, and associates contemplate the construction of a number of hydro-electric power plants on the Deschutes River in Jefferson, Wasco and Sherman Counties. The Hydro-Electric League of Oregon is interested in the project.

PORTLAND, ORE.—R. W. Cary, 455 Prescott Street, and associates have applied to the State Water Department for permission to build a hydro-electric plant on the Clackamas River.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has issued $2,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

DINUBA, CAL.—Contract has been let to the Osborn Electric Company, Turlock, for the installation of an ornamental lighting system, to cost about $60,000.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has preliminary plans under consideration for the erection of a new hydro-electric generating plant on Whiskey Creek, with capacity of about 24,000 hp. Application has been made to the State Water Supply Commission for permission to build the plant.

SAN BERNARDINO, CAL.—The Council has approved an ordinance for the installation of an ornamental street lighting system on portions of F and E Streets.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has acquired the property of the United Light, Fuel & Power Company. Improvements will be made to the system, which will be consolidated with the San Diego company.

SAN DIEGO, CAL.—A company is being organized by Edward Fletcher, 920 Eighth Street, to construct and operate a hydro-electric power plant on the Santa Ysabel and Black Canyon Creeks. It will have an initial capacity of about 3,100 hp. and will cost approximately $350,000.

SAN FRANCISCO, CAL.—The San Gorgonio Power Company, San Francisco, has preliminary plans under way for the erection of a new hydro-electric power plant on the San Gorgonio River, San Bernardino, with an initial capacity of 4,900 hp., to cost approximately $300,000, including machinery and transmission line. Application has been made to the State Water Supply Commission for permission to use the site.

SALT LAKE CITY, UTAH.—The Public Utilities Commission has granted the Utah Power & Light Company permission to extend its electric lighting and power system in Soldier Summit, a franchise having been granted by the Town Council.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has issued $2,112,000 in capital stock, part of the proceeds to be used for extensions and improvements.

AJO, ARIZ.—The New Cornelia Mining Company will build a power house and will install motors and other electrical equipment in connection with its new concentrating plant, to cost about $2,000,000.

## Canada

BANFF, ALTA.—The Calgary (Alta.) Power Company, is reported to be contemplating extensive developments to its property near Banff.

AGASSIZ, B. C.—The Chilliwack (B. C.) Electric Company, Ltd., it is reported, is installing a new hydro-electric plant at Agassiz.

FERNIE, B. C.—The East Kootenay Power Company, Ltd., successor to the British Columbia & Alberta Power Company, Ltd., is planning to erect a transmission line, which will be a duplication of a line already in operation.

NEW GLASGOW, N. S.—Arrangements have been made between the Nova Scotia Power Commission and the Pictou County Power Board whereby the former will begin work immediately on the development of Maley Falls on the East River of Sheet Harbor.

CALEDON, ONT.—The Cataract (Ont.) Electric Company, Ltd., has applied to the town officials for permission to erect its transmission lines in the township of Caledon.

OTTAWA, ONT.—Negotiations are under way between the Ottawa Electric Company and the Ontario Hydro-Electric Power Commission for the extension of the electric light and power service on the Montreal road from Eastview to St. Joseph d'Orléans.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued Sept. 5, 1922)

1,428,499. SIGN FLASHER; J. H. Wheelock, Worcester, Mass. App. filed May 11, 1917. Controlling system for sign flasher consisting of motor-operated contactors.

1,428,507. WIRELESS REPEATER SYSTEM; E. A. Sperry, Brooklyn, N. Y. App. filed March 12, 1920. Two step-by-step repeater motors controlled by wireless where one motor follows movements of other.

1,428,510. CONCENTRATED FLAMING-ARC LAMP FOR PROJECTORS; P. R. Bassett, Brooklyn, N. Y. App. filed June 26, 1920. Positive carbon has small mineralized core and negative electrode of smaller diameter.

(Issued Sept. 12, 1922)

1,428,529. ELECTRIC WELDING; F. S. Calswell, Columbus, Ohio, and A. M. Bennett, Westfield, N. J. App. filed Jan. 10, 1917. Initial impressed voltage higher than working voltage.

1,428,535. ADJUSTABLE JACK; O. C. Dennis, Wilmette, Ill. App. filed April 17, 1922. Used with plugs of various styles, lengths and contours.

1,428,563. CLEANING AND PLATING APPARATUS; G. W. Schweinsberg, Brooklyn, N.Y. App. filed Feb. 18, 1919. Apparatus automatically cleans and drains articles and maintains continuous supply to plating equipment.

1,428,567. COMBINED TELEPHONE RECEIVER AND TRANSMITTER; J. S. Timmons, Yonkers, N. Y. App. filed July 31, 1919. Transmitter held against throat transmits by muscular vibrations.

1,428,588. SPEED-REGULATING ARRANGEMENT; L. A. Hawkins, Schenectady, N. Y. App. filed Aug. 11, 1920. Controls voltage of motor-generator fed from trolley circuit.

1,428,603. LIGHTING FIXTURE; F. W. Mathieu, New York, N. Y. App. filed Dec. 4, 1918. Indirect and semi-indirect units.

1,428,631. TESTING AND ADJUSTING APPARATUS FOR CORD CIRCUITS; W. H. Harrison, Brooklyn, N. Y. App. filed Feb. 7, 1920. Determines whether supervisory relays function properly.

1,428,635. IGNITION SYSTEM; J. H. Hunt, Dayton, Ohio. App. filed Sept. 28, 1918. Dual ignition system.

1,428,638. PROCESS FOR PRODUCTION OF HEAT EXCHANGING BODIES; H. F. B. Jorgensen, Copenhagen, Denmark. App. filed July 24, 1920. Electrolytic deposition of automobile radiators on matrix of fusible metal that is melted out after the form has been deposited.

1,428,666. SHORT-CIRCUIT TERMINAL FOR THE MAGNETO-ELECTRIC IGNITION APPARATUS OF INTERNAL-COMBUSTION ENGINES; G. Steiner, Solothurn, Switzerland. App. filed May 28, 1920.

1,428,667. TESTING AND ADJUSTING APPARATUS FOR CORD CIRCUITS; J. F. Toomey, New York, N. Y. App. filed March 9, 1920. Determines if supervisory relays function properly.

1,428,717. HEATER FOR STITCHING MACHINES; J. Stangl, West Bend, Wis. App. filed Oct. 22, 1919. For maintaining wax in liquid state for waxing thread.

1,428,727. PROTECTIVE DEVICE FOR AUTOMOBILE BATTERIES AND GENERATORS; F. C. Wassman, Melrose Park, and E. Kendall, Maywood, Ill. App. filed Sept. 17, 1920. Switch operated from hand-brake on Fords prevents back flow of current.

1,428,743. ELECTRICAL MEASURING INSTRUMENT; E. C. Ballman, St. Louis, Mo. App. filed July 19, 1918. Ammeter with constant magnetic field and a magnetic field varying in accordance with measured current.

1,428,761. TRUNK CIRCUIT WITH INSTANTANEOUS DISCONNECT AND RECALL; H. D. Currier, Chicago, Ill. App. filed Jan. 29, 1914.

1,428,762. TELEPHONE SYSTEM; H. D. Currier, Chicago, Ill. App. filed Jan. 29, 1914. Simplified call distributing system.

1,428,803. ELECTRICAL DEVICE FOR HEATING LIQUIDS AND THE LIKE; H. J. Preston, Sydney, New South Wales. App. filed March 19, 1921. Placed in kettles, pans, etc.

1,428,825. ELECTRIC COOKER; G. H. Bindon, Ottawa, Can. App. filed Jan. 24, 1921. Portable electric resistance oven.

1,428,833. MAGNETIC BALANCE; T. S. Bindschedler, Detroit, Mich. App. filed Sept. 9, 1918. Means for testing relative penetrability by alternating magnetic flux of different materials for determining their relative hardness.

1,428,834. ELECTRIC RESISTANCE FOR REGULATING THE CANDLE POWER OF INCANDESCENT LAMPS; G. J. Bjerre, Copenhagen, Denmark. App. filed May 4, 1921. Granular resistance in bent tube with electrodes forming contact.

1,428,837. RELAY; A. H. Candee, Pittsburgh, and L. J. Hibbard, Wilkinsburg, Pa. App. filed Aug. 7, 1917. Protective device and system for electric railway vehicles.

1,428,856. SPARK-GAP APPARATUS; L. O. Parker, Swissvale, Pa. App. filed May 13, 1918. Method of adjusting gaps to utilize peak of voltage wave.

1,428,863. ELECTRICAL CONNECTION; H. M. Smith, Farmington, Conn. App. filed Jan. 6, 1921. Connection for vacuum cleaners and floor-scrubbing machines.

1,428,865. COMMUTATOR CYLINDER; C. W. Starker, Pittsburgh, Pa. App. filed Jan. 14, 1918. Cross-connectors supported at end of commutator cylinder opposite the armature.

1,428,869. PROTECTIVE DEVICE; G. M. Woods, Pittsburgh, Pa. App. filed April 9, 1919. For railway motors.

1,428,889. DYNAMO-ELECTRIC MACHINE CONSTRUCTION; C. E. Johnson, Los Angeles, Cal. App. filed Feb. 19, 1921. Induction-motor construction increases ventilation space.

1,428,909. ELECTRIC FURNACE; I. Rennerfelt, Djursholm, Sweden. App. filed March 3, 1921. Granulated resistance for heating crucible.

1,428,909. ELECTRIC FURNACE; I .Rennerfelt, Djursholm, Sweden. App. filed Aug. 12, 1921. For melting metals that vaporize at low temperatures.

1,428,910. METHOD OF OPERATING ELECTRIC FURNACES; I. Rennerfelt, Djursholm, Sweden. App. filed Aug. 12, 1921. Operating furnace with either two-phase or three-phase current.

1,429,002. TESTER FOR ELECTRIC DEVICES; W. Weinberg, Chicago, Ill. App. filed Sept. 20, 1920. For testing lamps, dry cells, buzzers, etc.

1,429,003. TELEPHONE-EXCHANGE SYSTEM; N. T. Whitaker, New York, N. Y. App. filed April 4, 1916. Busy line signal.

1,429,013. FURNACE FOR OXIDATION OF ATMOSPHERIC NITROGEN; A. U. Avera, Florence, Ala. App. filed March 26, 1921. Static electrical stress imposed on gases as they pass around arc.

1,429,025. ELECTRICALLY DRIVEN GRINDING MACHINE; H. W. Dunbar and A. Turner, Worcester, Mass. App. filed Dec. 1, 1920. All control of motors placed at operator's station on moving table.

1,429,060. WATER-HEATING FAUCET; O. F. Bruman, Zurich-Enge, Switzerland. App. filed April 13, 1921. Liquid itself acts as resistance element.

1,429,079. SPLIT INSULATOR; C. W. Kettron, Macomb, Ill. App. filed Feb. 4, 1916. Split insulator knob with means for preventing separation.

1,429,085. HEATING APPARATUS; A. McGary, New York, N. Y. App. filed Feb. 28, 1921. Parabolic resistance heater with motor fan forcing air through reflector.

1,429,094. ELECTRIC HAMMER; L. Paulero, Petersburg, Va. App. filed Dec. 5, 1917. Forced draft maintained through casing and around coils for cooling.

1,429,110. INSULATOR; H. D. Seavey, Greenfield, Mass. App. filed July 3, 1918. Method of connecting suspension or strain insulators.

1,429,130. HEATING DEVICE; A. E. Dutton, Cleveland, Ohio. App. filed July 9, 1921. Electrically heated radiator with forced draft.

1,429,170. ELECTROPLATING BARREL AND CATCHER; E. A. Severance, Burlington, Vt. App. filed June 30, 1921. Articles thoroughly drained and quickly removed from barrel in bulk.

1,429,172. ELECTRICAL OUTLET BOX; S. L. Sopenoff and M. Katcher, Brooklyn, N. Y. App. filed Feb. 24, 1920. Firmly clamps conduits into position.